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UNITED STATES DEPARTMENT OF AGRICULTURE • Agricultural Marketing Service
Agricultural Research Sevice

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A Farm Panel as a Source of Income and Expenditure Data

By Warren H. Vincent

To investigate the possibilities of establishing a representative sample of farms, using a system of data collection wherein farmers would report monthly their farm business expenses and receipts over a 12-month period, the U.S. Department of Agriculture entered into a cooperative agreement with Michigan State University in 1956. The Cooperative Extension Service had already established a farm record-keeping project wherein volunteer Michigan farmers submitted monthly financial reports to the Agricultural Economics Department of the University, which in turn processed the data currently using punched card equipment. The general success of this project and the need for current and accurate farm data by Government agencies led to the decision that such a system be offered to a group of farms selected on a probability basis. The study reported in this article was concerned more with the technical problems involved in establishing and maintaining a representative sample reporting certain data monthly than it was with the data so collected. If the technical problems could be economically surmounted, further consideration could be given to establishing such a system over a wider area—or an entire State or region, or even nationally. In this paper, the author describes the method of data collection used and the type of information obtained, discusses the problems of establishing and maintaining the sample, and evaluates the system in terms of one year of experience and its future potentialities.

This paper is approved for publication as Journal Article No. 2444 of the Michigan Agricultural Experiment Station. The assistance of Olan D. Forker, graduate assistant to the author, Nathan M. Koffsky, Ernest W. Grove, Earl E. Houseman of Agricultural Marketing Service, U.S. Department of Agriculture, and Wylie D. Goodsell, Agricultural Research Service, U.S. Department of Agriculture is gratefully acknowledged.

THE METHOD used in the study reported in this paper is one that was developed on an experimental basis at Michigan State University during 1955 and 1956 and adapted for the entire State in 1957. It is now used in an extension record-keeping project involving about 1,200 participating farmers in Michigan.

The sample in the study constituted 299 of the total 1,700 that used the method during 1957. Routine procedures in this study were the same as for the extension "volunteers," but the 1,400 extension cooperators received more individual attention than our sample because of the service aspects of that project. The procedures described below apply identically for all participants.

The cooperators provide both monthly and annual data. The annual information includes a beginning and ending inventory of real estate, machinery and equipment, feed and growing crops, and livestock by age and kind, plus such other pertinent data as cropping program, livestock performance, and family labor used in the business.

The monthly information is provided by the cooperators as a listing of all financial transactions on standardized printed forms which keep receipts separate from expense items. These forms provide space for the farmer to list without classification or in any particular order (usually chronological), the expenses, receipts, and capital investments for the month, showing amount and date of the transactions. Original copies of these listings are mailed in preaddressed envelopes to Michigan State University, and the duplicate copy is retained for reference by the farmer.

When the farmers' reports are received, the following operations take place:

1. The report is "checked in." This involves recording the date received, making sure the farmer has used the correct identification number, perusing the report for problems that may require special handling, and routing it either to a supervisor for special preliminary handling or to a coding clerk.

2. A code number is assigned to each transaction; the number is based on the description recorded by the farmer. It contains 5 digits, the first of which represents 1 of 9 possible major categories, such as farm operating expense, machinery purchased, improvement investments, livestock purchased, farm receipts, and so on. The second and third digits represent 7 of 34 intermediate types of farm operating expense, 23 intermediate types of farm receipts, and so on. The fourth and fifth digits represent further detail within the intermediate class. To illustrate, a baling expense is coded 10902 in which "1" means farm operating expense, "109" means the ninth type of farm operating expense (machine hire and custom work), and "10902" means the second type of custom expense (baling). This classification scheme permits stratification and tabulation by major, intermediate, or minor classes. There are approximately 550 possible code numbers in use for all farms, but ordinarily not more than 100 of these are active for any one farm.

3. Tabulating cards are punched and verified for each transaction. When punched, these cards contain the farm identification number, item code, item quantity, and dollar value of the transaction divided between farm operator and landlord.

4. Standardized alphabetic descriptions of expense and income of investment items are gang-punched in each card using a predetermined wording assigned to each number.

5. The cards are arranged by code number and tabulated quarterly to show quarterly totals and totals-to-date for all categories of expense, income, and farm investment for each cooperator.

6. The individual quarterly reports are mailed to the cooperator for his use.

7. Annual summaries for each cooperator are prepared from the cards and mailed to the cooperator. These summaries include annual totals and a detailed breakdown of certain categories for use in income tax reporting.

Establishing and Maintaining a Probability Sample

We depart now from the total on-going recordkeeping activities at Michigan State University to consider only that group of farmers selected by random sampling techniques.

A sample of 299 farms was drawn from four counties. The counties were selected by judgment to represent differences in levels of income, type of farming followed, and extent of off-farm employment. The sample of farms within counties was designed by Earl E. Houseman, Director, Statistical Standards Division, AMS, U.S. Department of Agriculture. Probability area sampling techniques were followed.[1] Area segments within counties were drawn at random and it was intended that each farmer within each segment drawn be contacted by an interviewer.

Once the fieldworker had made contact with the person or persons in position to make a decision about participation, he was asked (1) to determine his eligibility for participation, (2) to attempt to enroll the farmer in the project if he was eligible, and (3) if eligible, to fill out a questionnaire dealing with farm characteristics whether or not enrolled. A farmer was considered eligible if he (1) sold $250 worth of farm products in 1956, (2) farmed 3 or more acres of land, (3) intended to farm in 1957, and if (4) the farm's bookkeeper lived in the designated segment. Fieldwork was done by trained agricultural college students during the last 2 weeks of December 1956.

Results of the fieldwork are summarized in table 1. Approximately 53 percent of the contacts made were considered eligible, and 44 per-

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[1] Houseman, Earl E. APPLICATION OF PROBABILITY AREA SAMPLING TO FARM SURVEYS, in U.S. Department of Agriculture, Agr. Handb. 67, Washington: U.S. Govt. Print. Off. May 1954.

TABLE 1.—*Enrollment rate and response to interview by farmers contacted in the establishment of the Michigan State University probability sample of record-keeping farms, December 1956*

County	Number of farmers						Enrollment as percentage of—	
	Calls made	Contacts made [1]	Eligible	Refused [2]	Schedule only [3]	Enrolled w/ schedules	Eligible contacts	Total contacts
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Percent*	*Percent*
Huron	317	261	159	30	39	90	57	34
Kalamazoo	631	424	198	61	62	75	38	17
Mason	324	224	103	15	28	60	58	27
Shiawassee	456	348	218	84	60	74	34	21
Total	1, 728	1, 257	678	190	189	299	44	24

[1] The number of "face-to-face" contacts made with farm operator or his wife.
[2] The number refusing to answer schedule questions or to enroll.
[3] The number answering schedule questions but refusing to enroll.

cent of this number were enrolled (at least considered so by the fieldworker). It was found later that 81 of the 299 enrolled failed to submit their first report and hence could not be considered officially a part of the project. Of the 678 considered eligible, 28 percent refused to enroll but answered the survey questions, while the same number refused both to enroll and to provide the needed supplementary information.

Discussion with the fieldworkers yielded general agreement on the following experiences: (1) Consent to participate in a 12-month program of this type required more thoughtful consideration than most farmers were willing to give to it. It was easier for a farmer to say "no" and let the matter drop than to consider seriously the advantages to him as an individual or to others who might make use of the information collected. (2) Once the prospect decided not to enroll he tried to terminate the interview, and it was difficult for the fieldworker to obtain enough of the necessary information to complete a field schedule. (3) In general, farmers refused any information until the objectives of the project were explained and the proposition to enroll in the project was presented. (4) Many older farmers and part-time farmers could see little value to themselves in the program. Whereas the rules for eligibility were relatively lax, there was a tendency for prospects prematurely to declare themselves ineligible and for the fieldworker to accept this judgment. This led to a higher proportion of "ineligibles" than was anticipated.

On the basis of the sampling experience, one is inclined to conclude *a priori* that the methods used cannot yield a representative sample. However, further study of the sample was made. The characteristics of the enrolled group were compared with the characteristics of the refusals who responded to the enumerative survey. Also, the characteristics of the enrolled group who sent in 12 reports were compared with those of this group who did not complete the year.

The comparison of enrollees with those refusing to enroll yielded the following results: (1) The average (arithmetic mean) age of farm operators who enrolled was 6 years less than those responding to the survey but refusing to enroll. (2) The tillable acres per farm averaged 121 for those enrolled and 81 for those not enrolled. Those enrolled operated on the average 20 more acres in Mason County, 31 more in Huron County, 34 more in Kalamazoo County, and 58 more in Shiawassee County than those not enrolled. The farms were classified into groups—1 to 59, 60 to 119, 120 to 790 acres, and so on. Chi-square values were computed—they indicated a significant difference at the 10-percent level for Shiawassee County only.[2] (3) When farms were classified by type of farm according to source of income and chi-square values were computed to compare the distributions, it was found again that only Shiawassee County indicated significance at the 10-percent

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[2] Probability of 9 out of 10 that a difference no larger than the observed was due to chance alone.

Table 2.—*Number of reports submitted by enrolled farms in the Michigan State University probability farm sample, 1957*

Number of reports submitted	Number of farms
None	81
1 to 3	28
4 to 6	19
7 to 11	10
12	161
Total "enrolled"	299

Table 3.—*Chi-square values computed from selected characteristics of record-keeping cooperators at the beginning and end of 1957*

Basis for comparison	Degrees of freedom	Computed chi-square	Chi-square distribution value at 10 percent level
Age of operator	4	0. 698	1. 064
Total acreage per farm	10	17. 067	4. 870
Type of farm	4	1. 227	1. 064
Level of income	3	2. 184	0. 584

level. (4) When farms were classified by the amount of 1956 sales of farm products and the chi-square values were computed to compare these distributions, it was found that all counties indicated significance at the 10-percent level.

These results appear to indicate wide differences between groups when certain characteristics are compared, but little difference when other characteristics are compared.

Of equal interest to the comparison between cooperators and noncooperators was a comparison between those who enrolled and those who did not submit 12 monthly reports. This comparison gives some insight into the problem of maintaining a sample once established.

The extent of participation is summarized in table 2. The 161 farmers who completed the year represent 51 percent of the number considered enrolled and 74 percent of the number submitting one or more reports. To study sample changes within the year, it was decided to compare the 161 completions with the 299 enrolled. Comparisons were made for age of operator, total acreage per farm, type of farm, and level of income (table 3).

Chi-square values were computed to test the hypothesis that the distributions at the beginning of the year did not differ significantly from those at the end. These conclusions were reached:

1. There was a negligible change in the sample with regard to age of operator.

2. There was a significant change in the sample with regard to total acres per farm. The farms averaged 154 acres at the beginning and 148 acres at the end of 1957. These averages betray the significant changes occurring in both the large and the small farms, which tended to offset each other. There appeared to be more change in the sample for size of farm than for any characteristic compared.

3. As the relationship between size of farm and level of income is close, the heavy losses in small farms resulted in heavy losses in low-income farms. Of the initial 65 farmers with 1956 farm receipts of less than $1,200, only 28 completed the year. All of the initial 8 farmers with 1956 farm receipts of more than $25,000 completed the year successfully. The sample changed significantly with regard to level of income.

4. Although significant at the 10-percent level, there appeared to be little change in the sample with regard to type of farming. The farms were stratified similar to census classes (dairy, livestock, poultry, cash crops, and general) and nearly proportionate losses occurred for each class.

Evaluation

Evaluation is made in terms of the prospects of establishing and maintaining a representative sample, the costs, and the potentialities of a data-collection system in which expenses, receipts, and investments are reported monthly.

It was found that farmers are slow to commit themselves to a proposal that involves a full year of reporting confidential financial information. There is reason to believe that the enrollment rate would have been higher if the persons contacted could have had a longer time in which to weigh the merits of the proposal and to get a more detailed schooling in the objectives and procedures of the system. Also, more experienced and perhaps older interviewers could be expected to obtain a somewhat higher enrollment rate.

TABLE 4.—*Costs of establishing and maintaining the Michigan State University probability sample of record-keeping farms 1956–57* [1]

Item	Total	Average per farm	
		Enrolled (299)	Completed (161)
Field expenses:	*Dollars*	*Dollars*	*Dollars*
Mileage	1, 315		
Subsistence	909		
Salary	2, 570		
Subtotal	4, 794	15. 98	29. 77
Maintenance and operation:			
Labor	4, 875		
IBM charges	1, 475		
Cooperator supplies	1, 000		
Other supplies and services	600		
Field followup	683		
Professional travel	400		
Subtotal	9, 033	30. 14	56. 09
Total field and operational expenses	13, 827	46. 12	85. 86

[1] Does not include (1) overhead costs, such as use of buildings, utilities, calculating machines; (2) about 1/10 man equivalent of residence professional time; (3) about 54 days of county agricultural agents' time volunteered.

Apparently, it is difficult to retain a high level of participation for low-income farmers who operate small farms. This suggests that, if the experiment were repeated, resources would be more effectively used if the population were defined in such a way as to exclude very low-income farms.

Careful records of costs were kept, but, as this study was merged with an on-going record-keeping program, it is not easy to say what the costs would have been had the study been conducted alone. Fieldwork and cooperator supplies were charged directly to this study. Other costs were computed by allocating part of the total Michigan State University farm accounting costs to this project (table 4). To the costs shown may be added perhaps another $9,000 for overhead.

Costs of fieldwork to establish the sample averaged $25.70 per worker per day. This may be compared with $24.86 per worker per day for another enumerative survey of farms, conducted at about the same time. (This was a research project to evaluate a township extension program; it was sponsored by the Kellogg Foundation.) Field costs per farmer providing a full year's records averaged about $30 compared with $23 per interview in the Kellogg survey. Costs of enrolling a farmer in this program are comparable to those for taking a one-time survey, but if properly done, it results in the generation of a continuous flow of data that would be expensive to obtain from repeated surveys. Also, the costs of enrolling farmers would not be repeated for those who participated for more than a year.

Costs encountered in this study were probably higher than would be expected if it were repeated. Lessons learned from the field experience could lead to lower costs of establishing a sample. More importantly, many improvements have been developed in the data-processing procedure of the current extension project, and these could be used. In the present extension project of about 1,200 cooperators, the maintenance and operation costs average about $17 per farm compared with $30 experienced in this study.

Speculation as to the potentialities of a successfully established sample of farms that would report all operating expenses, investments, and receipts currently, is interesting. Among other things, the sample could:

1. Provide more accurate or useful data on prices received and paid by farmers than those provided by sources or methods now being used.
2. Provide information needed in studying certain marketing problems, such as marketing costs experienced in agriculture, effect on farm income of marketing at particular times, comparative returns resulting from alternative market outlets, and others.
3. Provide the opportunity to study farmers' intentions to use capital in specific ways, and to compare these with their actual actions. A preliminary step was taken in this direction in this study. Cooperators were asked at the time of enrollment to indicate the investments in machinery and farm improvements they intended to make in 1957, and when they planned to make them. These intentions were compared with actual investments. A more detailed study of this kind is in progress with the present extension sample.
4. Provide the basis for improved outlook information. When monthly data are available through time, it is possible to observe internal changes taking place in farm operations. When we see how farmers have reacted to certain price

changes in the past, it should be possible to predict more accurately what they will do under similar conditions. Also, when a satifactory rapport has been developed between the University and individual cooperators, many types of supplementary reports from the cooperators are feasible.

The study reported has answered some questions regarding the possibilities of establishing a representative sample of farmers reporting financial information on a monthly basis. The experience gained has been valuable and is expected to lead to other investigations of a related nature.

Evaluation of Agricultural Flood Damage by Airphoto Analysis of Flood-Plain Samples

By Kenneth C. Nobe and Henry W. Dill, Jr.

The United States Department of Agriculture is cooperating in an interagency study to plan for the future development and control of the water resources of the Potomac River Basin.[1] *One assignment undertaken by the Farm Economics Research Division, Agricultural Research Service, is that of appraising both the agricultural damages from floods, and the benefits from alternative combinations of control structures on the main stem and the major tributaries of the Potomac River. Techniques were developed for using sample cross-sectional data and airphoto interpretation, rather than the conventional detailed field surveys, to help us measure agricultural damage from floods. This paper discusses the development of these techniques and indicates how they may be applied to flood-damage studies in other areas.*

ECONOMIC EVALUATION of agricultural damage from floods is an integral part of studies designed to plan for future development and control of land and water resources. It is of particular importance in the design and justification of flood-control and multiple-purpose projects in rural areas. To compute benefit-cost ratios accurate flood-damage data are required, and these in turn are necessary for economic evaluation of individual water-control structures and for comparison of alternative projects. A benefit-cost ratio as used in this type of analysis is defined as "the arithmetic proportion of estimated average annual benefits to average annual costs, insofar as these factors can be expressed in monetary terms".[2]

Background Data

Four main types of data are required for the economic evaluation of agricultural damage from floods: (1) Flood frequencies; (2) areas inundated, by stage of flooding; (3) physical data on land use, yields, management practices, and inputs of land, labor and capital; and (4) economic data on value of inputs and returns to land in the flood plain, including economic losses from past floods. Necessary also are projections of future conditions, with and without a flood-control project. Combining these data into an economic evaluation is at best a complex process; it is limited further by lack of data on flood stage-land area inundated relationships in map form.

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[1] The Corps of Engineers, U.S. Army, is authorized to prepare a comprehensive plan for the development and conservation of water and related resources in the Potomac River Basin. Participating in this study are the U.S. Departments of Agriculture, Commerce, Interior, Health, Education, and Welfare, the Federal Power Commission, Atomic Energy Commission, Interstate Commission on the Potomac River Basin, National Capital Regional Planning Council, and Advisory Group for the Potomac River Basin, as well as other State and Federal agencies interested in the development of the Potomac Basin.

[2] Schwartz, H. E. DETERMINATION OF FLOOD FREQUENCIES IN A MAJOR DRAINAGE BASIN. Extrait des Compes Rendus et Rapports, Assemblee Generale de Toronto, 1957.

Maps showing stage-area relationships would be the ideal base for study of the effect of flooding on present land use and cropping systems. They would serve also as a base for locating areas in which land use had changed in the past and in which land enhancement would be expected as a result of varying degrees of flood control from potential structures. The lack of stage-area maps for the Potomac River led to a test of an alternative method of determining stage-area relationships that would allow for correlation of land use to stage of flooding.

The use of airphoto interpretation as a tool for flood-damage appraisal was suggested by a report on a study carried out by the New England-New York Inter-Agency Committee.[3] The Potomac Survey differs from the New England-New York study, in that for the latter, stage-area maps were available for part of the study area. For the Potomac Survey, it was necessary to find a substitute for stage-area maps. Limitations of time and funds precluded detailed cross-sectional mapping and the transfer of such field information to airphotos by using photogrammetric plotting equipment. A test project was carried out, therefore, to learn whether the use of airphoto interpretation, combined with a field survey of a sample of representative river valley cross sections, could provide us with a reasonably accurate estimate of overall stage-area relationships.

How Data Were Obtained

Potomac River mile 203, which is approximately 5 miles southwest of Williamsport, Md., was chosen as the test area and was later studied in the field (figs. 1 and 2). This section of the river is characterized by a relatively broad flood plain in agricultural use on the inside bend of the river, and a narrow wooded flood plain on the outside bend.

The inundation line of the 1936 flood (flood of record) was superimposed on an airphoto of the test area. This was later broken into four strata, each a half mile in length. Strata 1 and 3 occur on the West Virginia side and strata 2 and 4 on the Maryland side. In each stratum, the point was chosen at random and a straight line was drawn through it in such a way that it intersected the river at a right angle to the tangent of the river.

Cross-sectional data were obtained along these lines. They were used to represent the stratum in which they occurred, and measurements were weighted equally to represent total flood-plain land in the study area. The upper edge of the river bank (point of zero flooding) was set at 18 feet, and the 1936 floodline at 43 feet.[4] This allowed for the delineation of 5 flood-stage lines spaced at 5-foot intervals in elevation.

The elevation points were plotted on an airphoto and measured with a 0.0001-foot scale ruler—0.0001 foot is equal to 20 feet lineal distance—and recorded by stage (table 1). Stage totals were expressed as percentages and applied to the calculated total acreage of the flood plain (based on a dot grid count of delineated flood-plain area), to obtain acreage by stage.

Total of the stage 1 measurement figures, for example, is 0.0019; for all stages, it is 0.0176. Stage 1, therefore, includes 10.8 percent of the total flood-plain area (0.0019/0.0176). The calculated total acreage of the flood-plain area is 202 acres; therefore, the flood-plain acreage in stage 1 is 21.8 acres (10.8x202).

Airphoto analysis was used to ascertain land use by stage. Four major types of land use were measured—cropland, woodland, pasture, and other (industrial, residential, transportation routes). These calculations are shown in table 2. The distance measured in stratum 1, stage 1, for example, is 0.0006; it falls in the woodland category. For stage 2 in stratum 1, the total measured distance is 0.0035; of this total 0.0015 is cropland and 0.0020 is woodland. The recorded measurements of the four strata were weighted equally, and the totals were converted to percentages. The percentages in turn were applied to the total flood-plain acreage to indicate land use by stage (table 2).

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[3] Dill, H. W. Jr. PHOTO INTERPRETATION IN FLOOD CONTROL APPRAISAL. Photogrammetric Engineering, March 1955.

[4] Calculations based on the Shepherdstown flood gage suggest that these assumed elevations approximate closely the actual situation in the study areas.

Table 1.—*Estimated total acreage of flood plain by stage, Potomac River mile 203, reach P-3* [1]

Airphoto measurements	Flood-plain stages					Total
	Stage 5 (1,936 to −5)	Stage 4 (−5 to −10)	Stage 3 (−10 to −15)	Stage 2 (−15 to −20)	Stage 1 (−20 to river)	
	Feet	*Feet*	*Feet*	*Feet*	*Feet*	*Feet*
Stratum 1	0. 0004	0. 0006	0. 0012	0. 0035	0. 0006	0. 0063
Stratum 2	. 0003	. 0004	. 0009	. 0007	. 0002	. 0025
Stratum 3	. 0005	. 0006	. 0009	. 0053	. 0006	. 0079
Stratum 4	(2)	(2)	(2)	. 0004	. 0005	. 0009
Total	0. 0012	0. 0016	0. 0030	0. 0099	0. 0019	0. 0176
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Percentage [3]	6. 8	9. 1	17. 0	56. 3	10. 8	100. 0
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Acreage	13. 7	18. 4	34. 4	113. 7	21. 8	202. 0

[1] The estimated total acreage is given at 202 acres, a figure arrived at by airphoto analysis. Measurements were made on airphotos by a scale of 0.0001 feet=20 feet lineal distance. The percentage of total acreage in each stage is based on 4 hypothetical cross-sections of the flood-plain area. The individual cross-sections were limited to one side of the river in each case.

[2] Insignificant amounts.

[3] The percentages of total lineal distance across the entire flood plain (as measured on airphotos) that lie within individual stages are synonymous with the percentages of the 202 acres in river mile 203 that lie within these stages.

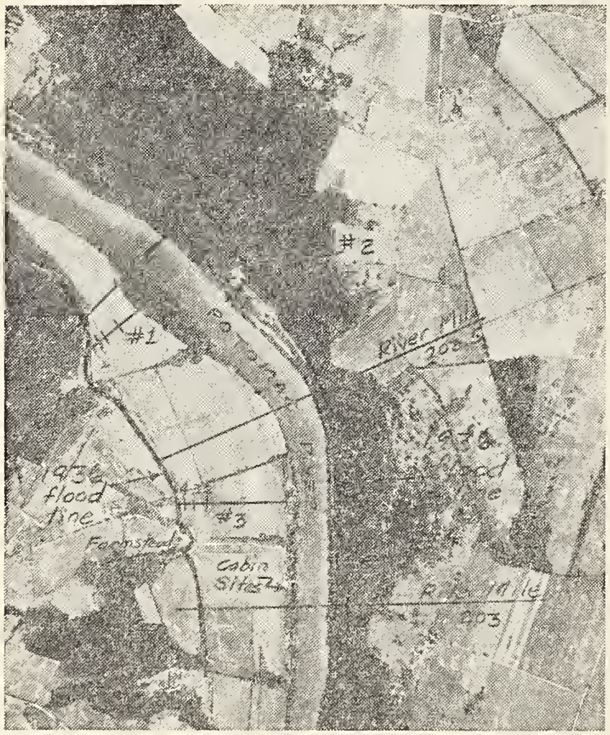

Figure 1.—Flood plain land along mile 203 of the Potomac River. Study cross-sections are shown by number. The dark areas are woodland, the light gray areas cropland. There are cabins in the narrow band of woodland on the left bank of the river. Airphoto from Commodity Stabilization Service, U.S. Department of Agriculture. Scale 1 : 20,000.

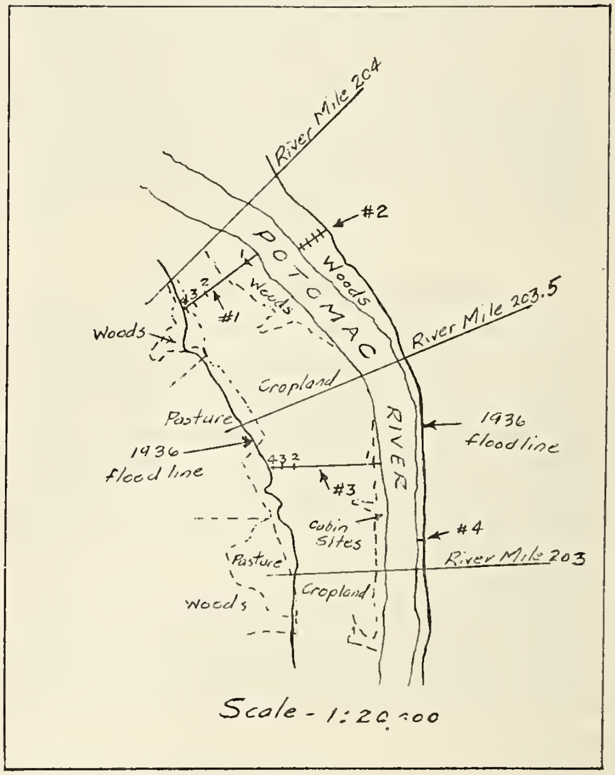

Figure 2.—Sketch of major land uses shown in airphoto reproduced in figure 1.

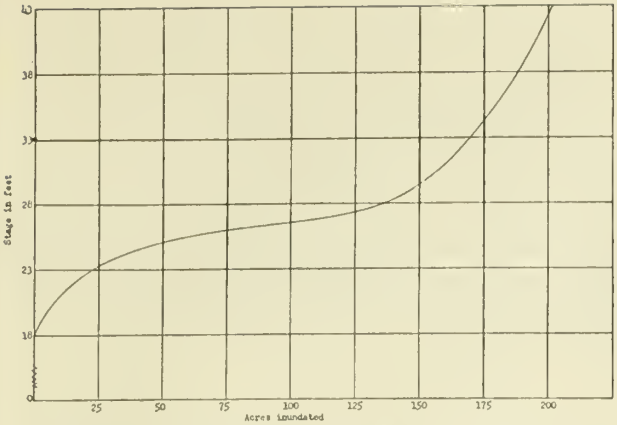

FIGURE 3.—Flood stage-land area inundated relationship for mile 203 of the Potomac River.

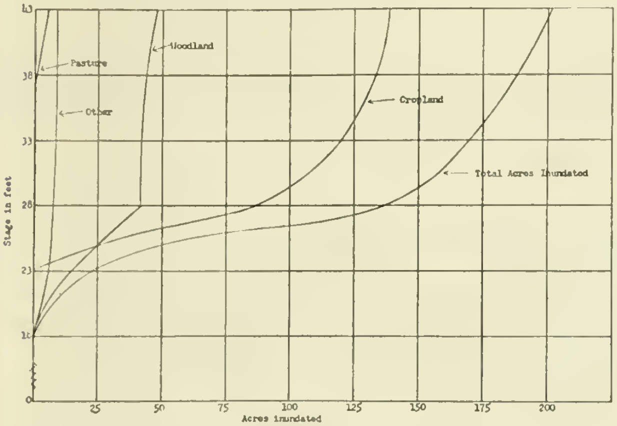

FIGURE 4.—Flood stage-land use-area relationships for mile 203 of the Potomac River.

The data included in tables 1 and 2 were used to construct stage-area curves for the test area (figs. 3 and 4). Figure 3 shows total area (in acres) in relation to flood stage in feet. Figure 4 shows both a total area curve as well as individual curves for each land use. A visual comparison of these curves with figures 1 and 2 begins to bear out some of the relationships shown in these curves. The combined area in stages 2 and 3, for example, can be verified as a high proportion of the total flood-plain area. Figure 1 also indicates that most of the pasture acreage occurs in stage 5 and that a high proportion of the woodland is in stage 1.

Application of Findings

The results of this test case indicate that reasonably accurate stage-area relationships can be ascertained from data obtained from a sample of river-valley cross sections. Damage estimates by

TABLE 2.—*Estimate of land use of flood plain by stage, Potomac River mile 203, reach P-3*[1]

Airphoto measurements	Crops	Woods	Pasture	Other
FLOOD PLAIN STAGE 5				
Stratum 1________foot__	-------	-------	0. 0004	------
Stratum 2_________do___	-------	0. 0003	-------	------
Stratum 3_________do___	0. 0005	-------	-------	------
Stratum 4_________do___	(2)	(2)	(2)	(2)
Total___________do___	. 0005	. 0003	. 0004	------
Percentage of area acres__	41. 7	25. 0	33. 3	------
Acreage__________do___	5. 7	3. 4	4. 6	------
FLOOD PLAIN STAGE 4				
Stratum 1________foot__	. 0005	-------	. 0001	------
Stratum 2_________do___	-------	. 0002	-------	0. 0002
Stratum 3_________do___	. 0006	-------	-------	------
Stratum 4_________do___	(2)	(2)	(2)	(2)
Total___________do___	. 0011	. 0002	. 0001	. 0002
Percentage of area acres__	68. 8	12. 5	6. 2	12. 5
Acreage__________do___	12. 7	2. 3	1. 1	2. 3
FLOOD PLAIN STAGE 3				
Stratum 1________foot__	. 0012	-------	-------	------
Stratum 2_________do___	. 0009	-------	-------	------
Stratum 3_________do___	. 0009	-------	-------	------
Stratum 4_________do___	(2)	(2)	(2)	(2)
Total___________do___	. 0030	-------	-------	------
Percentage of area acres__	100. 0	-------	-------	------
Acreage__________do___	34. 4	-------	-------	------
FLOOD PLAIN STAGE 2				
Stratum 1________foot__	. 0015	. 0020	-------	------
Stratum 2_________do___	. 0007	-------	-------	------
Stratum 3_________do___	. 0053	-------	-------	------
Stratum 4_________do___	-------	. 0004	-------	------
Total___________do___	. 0075	. 0024	-------	------
Percentage of area acres__	75. 8	24. 2	-------	------
Acreage__________do___	86. 2	27. 5	-------	------
FLOOD PLAIN STAGE 1				
Stratum 1________foot__	-------	. 0006	-------	------
Stratum 2_________do___	-------	. 0002	-------	------
Stratum 3_________do___	-------	-------	-------	. 0006
Stratum 4_________do___	-------	. 0005	-------	------
Total___________do___	-------	. 0013	-------	. 0006
Percentage of area acres__	-------	68. 4	-------	31. 6
Acreage__________do___	-------	14. 9	-------	6. 9

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[1] The estimated total acreage is given at 202 acres, a figure arrived at by airphoto analysis. Measurements were made on airphotos by a scale of 0.0001 feet=20 feet lineal distance. The percentage of total acreage in each stage is based on 4 hypothetical cross-sections of the flood-plain area. The individual cross-sections were limited to one side of the river in each case.

[2] Insignificant amounts.

stage are possible when these data are combined with flood-loss data. It indicates further that airphoto-interpretation techniques and sample cross-section data are useful tools in situations in which stage-area maps and other necessary hydrological data are lacking.

The general approach used in the test case has been accepted for use in the evaluation of agricultural flood damages on the main stem and major tributaries of the Potomac River. The procedure to be followed involves four steps: (1) A sample of half-mile river segments will be selected from each designated damage reach; (2) the inundation line of the largest flood of record will be drawn on airphotos and the total flood-plain acreage determined by dot grid count; (3) a field crew will survey a single cross-section in each of the sample river-mile segments; and (4) field data will be summarized according to the method described in the preceding section.

Comparative Methods of Surveying Horticultural Specialty Crops

By R. A. McGregor and O. M. Frost

A program of estimates covering eight classes of nursery products and four selected cut flowers grown in 5 States was undertaken in late 1956 by the Fruit and Vegetable Statistics Branch of the Agricultural Estimates Division, AMS. The initial survey was an almost complete enumeration with estimates being required for only a few small nonrespondents whose size of operation had previously been established. To reduce time and costs, random sampling was tested in a 1957 survey in these same States. A sample was drawn to measure 1957 sales in relation to those made in 1956 with sampling errors of about 2 percent by States for each item. The sample was checked against (1) the results obtained from a general mailing to all producers with several followups and (2) the results obtained from similar mailings and followups of large nonrespondents by personal interview. Final results show that more accurate estimates are obtained from general mailings to all known producers with selective followups of the larger nonrespondents.

IN DECEMBER, 1956, the Fruit and Vegetable Branch of the Agricultural Estimates Division, Agricultural Marketing Service, began a new program of crop reports on the horticultural specialties industry. Five States were selected for a pilot study on the basis of their geographic distribution and importance in the industry.

Considerable time was spent in assembling a list of nearly 8,700 potential producers in California, Colorado, Florida, Illinois, and Iowa. Each was mailed a questionnaire which sought information on size and type of production. Approximately 90 percent answered the inquiry after five mailings were made. Nonrespondents were classified by personal contacts or from information obtained from secondary sources.

About 2,800 qualified as commercial growers of the products to be estimated in future surveys. A commercial producer is defined as one who grows and sells in a calendar year cut flowers, flowering plants, or nursery products with a total value of $1,000 or more.

The first production survey, made during the winter of 1956–57, covered four selected cut flowers and eight classes of nursery products. The mailed inquiry yielded an 80-percent return. Four general mailings, followed by special delivery airmail letters to larger nonrespondents, were used to obtain this return. Followup work through personal contact was concentrated on larger growers.

The data were summarized by seven size strata established after the initial enumeration. They covered 97 percent of the estimated sales of four selected cut flowers and 94 percent of the estimated sales of eight classes of nursery products.

Nonrespondents were classified according to size of operation. Estimates for these represented mainly the operations of smaller growers; they were made on the basis of size group averages.

In June, 1957, a similar size classification survey was undertaken in Michigan, Ohio, Oregon, New York, and Texas. Five general mailings were made to a list of 11,700 names in these States. About 11 percent failed to reply. Nonrespondents were again checked at the field level to obtain a complete size classification. About 3,700 growers qualified as commercial producers of the selected cut flowers and nursery products.

During the winter of 1957–58, a second production survey was undertaken. This covered 1957 operations in the original pilot States and the five additional States. For cut flowers, reports were received from 86 percent of the growers covering 98 percent of total commercial sales. In the case of nursery products, reports were received from 75 percent of the growers covering 94 percent of commercial sales.

To obtain this high return, it was again necessary to mail five requests and to use selective followup field contacts on the larger nonrespondents. Nonrespondents were classified by size of operation. Estimates were made for nonrespondents in each size group in line with reports received for that size group.

Drawn Sample Tested in Second Survey

To reduce time and cost in such surveys, the practicability of sampling was investigated. A general-purpose sample would not be efficient because many producers tend to specialize in one or two of the products covered in the surveys. A medium-sized overall producer, for example, sometimes turned out to be a rather large chrysanthemum producer, or a large rose grower would sometimes grow a few carnations. Each flower or class of nursery products had therefore to be considered in relation to its own universe. It was necessary to draw a separate sample for each class of products in each State.

One prerequisite of an efficient sample is that pertinent control data for the universe be available. The study was therefore limited to the five States covered in the 1956–57 production survey. With the high response rate obtained in the original survey, it appeared that a valid comparison could be made between results from the sample and those from a complete enumeration resulting from a mailed survey with followup field contacts.

A sample was drawn in the fall of 1957 for the 1957–58 production survey. The sample for each class of products was large enough by States, so that sampling errors would be within 2 percent. Growers in the 1957 survey were classified into seven strata, based on 1956 sales. It was considered necessary to enumerate all growers in stratum 7, consisting of those with a sales volume of $50,000 and over for a given product. A sample was drawn for each of the remaining six groups. The size limits for the seven strata were as follows:

Stratum	*Sales limits (dollars)*
1	0 to 999.
2	1,000 to 4,999.
3	5,000 to 9,999.
4	10,000 to 14,999.
5	15,000 to 24,999.
6	25,000 to 49,999.
7	50,000 and over.

The number of growers included in the sample varied by State and by product, depending on the variances of the data. On the average, the sample for all items covered about 35 percent of the producers of a given product in each State.

Sample Allocation

The following relationships were used to allocate the sample by strata. The computations are for California carnations, but they were similar for all other products involved in the survey.

$$\text{Total Sample, } \eta = \frac{\Sigma^2(\omega_i{}^1\sigma_i)}{(\sigma_{\overline{X}})^2 + \Sigma\left(\frac{\omega_i{}^2\sigma_i{}^2}{N_i}\right)}$$

$$\text{Stratum 1, } \eta_1 = \eta\left[\frac{\omega_1{}^1\sigma_1}{\Sigma(\omega_i\sigma_i)}\right]$$

$$\text{Stratum 2, } \eta_2 = \eta\left[\frac{\omega_2{}^1\sigma_2}{\Sigma(\omega_i{}^1\sigma_i)}\right]$$

Etc.

In table 1, N_i is the number of producers in each stratum, σ_i is the standard deviation of the number of 1,000 units sold (blooms in this case), and w_i is the adjusted stratum weight excluding stratum 7 growers who were enumerated. The

TABLE 1.—*California carnation computations*

Stratum	N_i	G_i	w'_i	$w'_i G_i$	$(w_i G_i)^2$	$\frac{(w_i G_i)^2}{N_i}$
1	6	9. 2	0. 046	0. 422	0. 178	0. 030
2	30	48. 5	. 230	11. 155	123. 319	4. 111
3	26	89. 8	. 198	17. 780	316. 128	12. 158
4	22	118. 5	. 168	19. 901	396. 050	18. 002
5	26	226. 5	. 198	44. 847	2011. 253	77. 355
6	21	445. 5	. 160	71. 280	5080. 838	241. 945
7	26	[1]	[1]	[1]	[1]	[1]
Sum	157		1. 00	165. 385		353. 601

[1] Enumerated.

numerical value of N was set to provide a sampling error of 2 percent in the final estimate, including stratum 7 producers who were enumerated.

$$\text{Desired } \sigma_{\bar{X}} = (.02)\bar{X}$$

In this example, $\bar{X} = 636.6$, desired $\sigma_{\bar{x}} = 12.7$. This means that the standard error of the average for the first 6 strata must be $= 15.2$. For California carnations, this resulted in the sample allocation shown in table 2.

TABLE 2.—*California carnation producers, by stratum*

Stratum	Producers	
	Total	Drawn
	Number	*Number*
1	6	1
2	30	3
3	26	5
4	22	6
5	26	12
6	21	20
7	26	26
Total	157	73

Survey Procedures and Results

Production schedules were mailed to all commercial growers on the list. In the fall of 1957, some new growers were added to the various State lists. Five requests were made by mail, and followup field contacts were made for selected nonrespondents. Reports for all nonrespondents in the drawn sample were obtained by field contact.

In the general listings, reports were tabulated by size group and product within States. If the value of sales for the current report departed by more than one size group from the predetermined size group, the report was listed in the size group based on the current report. The only exception to the rule was for producers in strata 6 and 7. Reports showing material differences between the 1957 sales and the predetermined size group for the two classes were tabulated on the basis of the size group indicated by 1957 sales.

For the drawn sample, reports were tabulated in the size groups in which they were drawn, regardless of the change that might have been indicated for the 1957 value.

In summarizing the reports, average numbers of cut flower and nursery products sold in 1957 were computed. These were expanded on the basis of number of growers in each size group. Estimates for the other items, such as plants in production for cut flowers and inventory numbers for nursery products, were based on the relationship of the item to number of cut flowers or nursery products sold in 1957, as reported by other producers within the same size class.

Three different summaries were prepared, as follows:

1. Reports received *only* from direct mailings were expanded to a State basis for all growers. The number of growers in the universe was changed to allow for new growers added to the lists in the fall of 1957.
2. Reports received from direct mailing and reports received by field contact for selected nonrespondents were expanded to a State basis for all growers. The number of growers in the universe was changed to allow for

Table 3.—*Comparative survey summary for eight classes of nursery products, by selected States*

State	Drawn sample indication as a percentage of published totals (mailed and followup)			
	Producers	Sales	Wholesale value	Jan. 1, 1958, inventory
	Percent	*Percent*	*Percent*	*Percent*
California	101. 4	98. 9	97. 4	99. 6
Colorado	104. 6	95. 4	100. 4	97. 5
Florida	96. 2	96. 3	101. 9	78. 9
Illinois	98. 7	86. 6	86. 3	99. 5
Iowa	100. 0	93. 0	95. 3	100. 8
Average	99. 2	[1] 96. 4	96. 7	[1] 96. 6

[1] Weighted by value of sales.

Table 4.—*Comparative survey summary for five selected cut flowers, by selected States*

State	Drawn sample indication as a percentage of published totals (mailed and followup)				
	Producers	Sales	Wholesale value	Plants in production	
				1957	Indicated 1958
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*
California	105. 7	94. 0	93. 5	93. 9	91. 9
Colorado	95. 7	97. 1	93. 9	95. 1	89. 9
Florida	104. 7	99. 4	100. 7	96. 4	92. 4
Illinois	104. 8	97. 3	97. 1	97. 2	95. 6
Iowa	102. 5	91. 3	93. 4	90. 4	88. 7
Average	103. 7	[1] 96. 8	96. 7	[1] 95. 4	[1] 92. 4

[1] Weighted by value of sales.

growers going out of business and for new growers added to the list in the fall of 1957.

3. Reports from growers in the drawn sample (either by mail or field contact) were expanded to a State basis for all growers.

The number of growers in the universe was held to the level established prior to drawing the sample.

A. *Basis of estimate in published report.*—The figures published in June 1958 under Sp Cr 6–1 (58) "Cut-Flowers" and Sp Cr 6–2 (58) "Nursery Products" are based on method (2) as outlined above.

Table 5.—*Comparative survey summary for nursery products, by product, selected States*

Product	Drawn sample indication as a percentage of published total			
	Producers	Sales	Wholesale value	Jan. 1, 1958, inventory
	Pct.	*Pct.*	*Pct.*	*Pct.*
Conifers	101. 2	99. 8	93. 6	101. 7
Broadleaved evergreens	104. 1	95. 7	97. 4	92. 8
Deciduous shade trees	98. 5	87. 4	86. 4	90. 1
Deciduous shrubs	98. 7	92. 9	94. 3	100. 6
Rose plants	95. 8	108. 0	103. 0	105. 7
Deciduous fruit and nut trees	96. 2	95. 0	93. 3	92. 8
Grapevines	92. 7	105. 0	96. 1	114. 5
Citrus and subtropical fruit trees	96. 0	94. 0	97. 9	86. 6
Average	99. 2	[1] 96. 4	96. 7	[1] 96. 6

[1] Weighted by value of sales.

Table 6.—*Comparative survey summary for cut flowers, by product, in selected States*

Item	Drawn sample indication as a percentage of published totals				
	Producers	Sales	Wholesale value	Plants in production	
				1957	Indicated, 1958
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Carnations	101. 6	95. 3	94. 7	94. 8	91. 3
Chrysanthemums, Standard	102. 0	95. 2	92. 0	95. 2	89. 4
Pompon	103. 0	99. 8	100. 7	101. 8	93. 8
Gladiolus	113. 6	98. 1	99. 4	93. 7	94. 6
Roses	101. 8	95. 2	94. 5	93. 7	93. 4
Average	103. 7	[1] 96. 8	96. 7	[1] 95. 4	[1] 92. 4

[1] Weighted by value of sales.

B. *Drawn sample versus mailed survey and followup.*—Tables 3, 4, 5, and 6 compare results from the drawn sample with the published estimates by State and item, respectively, for nursery products and cut flowers. As noted earlier, the mailed survey and followup method yielded a high return, necessitating little estimating in terms of total sales. The exhibits compare the total indicated by the drawn sample with that from the mailed and followup survey on a percentage basis for

TABLE 7.—*Comparative survey results for nursery products, selected States*

State, item, and type of survey	Drawn sample and mailed survey only indications as a percentage of published totals (mailed survey and followup)			
	Producers	Sales	Wholesale value	Jan. 1, 1958, inventory
California:				
Broad-leaved evergreens:	*Percent*	*Percent*	*Percent*	*Percent*
Drawn sample	102. 7	93. 1	91. 8	97. 3
Mailed only	100. 0	85. 4	92. 4	84. 6
Rose plants:				
Drawn sample	94. 8	108. 1	103. 1	105. 8
Mailed only	100. 0	100. 6	100. 6	100. 1
Deciduous fruit and nut trees:				
Drawn	106. 3	94. 3	92. 2	19. 1
Mailed only	100. 0	100. 3	99. 2	100. 1
Colorado:				
Conifers:				
Drawn sample	109. 4	85. 2	94. 6	92. 9
Mailed only	100. 0	106. 1	103. 3	116. 1
Deciduous shade trees:				
Drawn sample	104. 3	103. 2	89. 5	104. 9
Mailed only	100. 0	103. 2	87. 5	115. 8
Florida:				
Broad-leaved evergreens:				
Drawn sample	109, 0	104. 5	113. 6	77. 3
Mailed only	100. 0	98. 0	112. 3	86. 4
Citrus and subtropical fruit trees:				
Drawn sample	94. 9	93. 8	93. 9	82. 8
Mailed only	100. 0	99. 6	128. 6	92. 9
Illinois:				
Conifers:				
Drawn sample	101. 4	92. 0	90. 3	103. 1
Mailed only	100. 0	86. 0	90. 3	74. 1
Deciduous shade trees:				
Drawn sample	99. 4	87. 2	84. 5	84. 9
Mailed only	100. 0	97. 0	104. 7	63. 6
Broad-leaved evergreens:				
Drawn sample	99. 0	103. 2	75. 3	112. 2
Mailed only	100. 0	59. 2	88. 2	51. 1
Iowa:				
Deciduous shrubs:				
Drawn sample	103. 8	97. 5	100. 0	97. 6
Mailed only	100. 0	100. 0	100. 0	99. 8
Deciduous fruit and nut trees:				
Drawn sample	116. 7	99. 7	99. 4	99. 7
Mailed only	100. 0	100. 0	100. 0	99. 9
Average:				
Drawn sample	100. 9	[1] 98. 5	100. 9	[1] 96. 1
Mailed only	100. 0	[1] 94. 1	97. 4	[1] 88. 7

[1] Weighted by value of sales.

ease of comparison. The drawn sample for nursery products had a downward bias of 3.6 percent for the five States under survey, based on the number of plants sold. Likewise, the cut-flower drawn sample data had a downward bias of 3.2 percent. By individual products, sales of conifers were about the same on both surveys, whereas the drawn sample was nearly 13 percent below the published figure on deciduous shade trees. In contrast, the drawn sample for rose plants was 8 percent above the published figure (mailed survey and followup). For cut flowers, sales of pompon chrysanthemums were about the same on both surveys, while the drawn sample showed a small to moderate

TABLE 8.—*Comparative survey results for cut flowers, selected States*

State, item, and type of survey	Drawn sample and mailed survey only indications as a percentage of published totals (mailed survey and followup)				
	Producers	Sales	Wholesale value	Plants in production	
				1957	Indicated, 1958
California:					
Carnations:	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Drawn sample	102.6	94.3	96.3	94.0	92.0
Mailed only	100.0	99.1	97.0	98.8	92.0
Standard Chrysanthemums:					
Drawn sample	107.4	96.3	92.2	97.5	92.1
Mailed only	100.0	98.5	99.4	100.0	101.1
Colorado:					
Carnations:					
Drawn sample	90.1	97.6	93.7	97.1	91.0
Mailed only	100.0	103.1	104.2	101.6	98.3
Pompon Chrysanthemums:					
Drawn sample	105.3	102.8	102.9	88.0	89.5
Mailed only	100.0	87.5	87.7	89.5	96.4
Florida:					
Pompon Chrysanthemums:					
Drawn sample	100.0	104.6	104.6	102.9	92.4
Mailed only	100.0	73.3	81.8	134.4	118.0
Gladiolus:					
Drawn sample	111.3	97.1	98.8	93.8	93.8
Mailed only	100.0	107.5	109.4	106.2	106.2
Illinois:					
Gladiolus:					
Drawn sample	116.4	106.0	106.1	98.2	103.9
Mailed only	100.0	98.9	98.3	101.8	101.9
Roses:					
Drawn sample	109.1	100.5	99.3	100.6	99.9
Mailed only	100.0	103.7	102.5	104.2	103.8
Iowa:					
Standard Chrysanthemums:					
Drawn sample	96.8	97.2	101.0	92.6	95.0
Mailed only	100.0	101.4	101.0	101.2	101.2
Roses:					
Drawn sample	100.0	99.9	100.0	100.0	100.0
Mailed only	100.0	99.5	99.4	101.1	101.1
Average:					
Drawn sample	103.9	[1] 98.4	97.3	[1] 96.8	[1] 94.6
Mailed only	100.0	[1] 98.2	99.6	[1] 96.6	[1] 97.7

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[1] Weighted by value of sales.

downward bias for carnations, standard chrysanthemums, gladiolus, and roses.

C. *Drawn sample versus mailed survey without followup.*—Tables 7 and 8 compare the total indicated by the drawn sample with the total based on a mail survey only, by State and item, respectively, for nursery products and cut flowers. Selected items were taken in each State. For cut flowers (table 8) there was no material difference in the 5-State average for the two methods of survey. But the greater differences were more often shown on the mailed survey without followup, especially for Colorado and Florida pompon chrysanthemums. In the case of nursery products, the drawn-sample survey was somewhat better than the mailed survey without followup. Direct summarization without followup introduced large errors for broad-leaved evergreens grown in California for conifers and broad-leaved evergreens grown in Illinois. These large errors

TABLE 9.—*Comparative survey results for selected products, by three methods of summarization, selected States*

Method	Total number of producers in universe used for expansion	Number sold	Wholesale value	Plants in production	
				1957	1958
California:					
Carnations:		*Thousands*	*Thousands*	*Thousands*	*Thousands*
Mailed and followup	[1] 153	102, 468	4, 816	9, 300	10, 005
Mailed only	[1] 153	101, 574	4, 672	9, 193	9, 987
Drawn sample	[2] 157	96, 657	4, 640	8, 741	9, 205
Florida:					
Gladiolus:		*Thousand dozens*	*Thousands*	*Acres*	*Acres*
Mailed and followup	[1] 62	16, 471	9, 059	8, 000	8, 000
Mailed only	[1] 62	17, 708	9, 916	8, 500	8, 500
Drawn sample	[2] 69	15, 988	8, 953	7, 500	7, 500
Illinois:					
Roses:		*Thousands*	*Thousands*	*Thousands*	*Thousands*
Mailed and followup	[1] 40	45, 714	3, 703	2, 142	2, 122
Mailed only	[1] 40	47, 482	3, 799	2, 236	2, 206
Drawn sample	[2] 44	45, 944	3, 676	2, 154	2, 120

Method	Producers	Number sold	Wholesale value	Jan. 1, 1958 inventory
California:				
Broad-leaved evergreens:		*Thousands*	*Thousands*	*Thousand plants*
Mailed and followup	[1] 331	8, 060	5, 803	12, 000
Mailed only	[1] 331	6, 885	5, 364	10, 153
Drawn sample	[2] 340	7, 503	5, 327	11, 683
Florida:				
Citrus and subtropical fruit trees:				
Mailed and followup	[1] 470	1, 886	2, 263	3, 322
Mailed only	[1] 470	1, 878	2, 911	3, 087
Drawn sample	[2] 446	1, 770	2, 124	2, 751
Illinois:				
Conifers:				
Mailed and followup	[1] 204	736	2, 136	3, 133
Mailed only	[1] 204	633	1, 836	2, 321
Drawn sample	[2] 207	677	1, 929	3, 232

[1] Number of producers, adjusted for those going out of business and those entering into production for the first time in 1957.

[2] Number of producers in drawn sample as determined from 1956 survey.

arose mainly in estimating for larger nonrespondents in the stratum expansions in the mail survey, chiefly for strata 6 and 7.

D. *Drawn sample versus mailed survey with and without followup.*—A comparison for selected items in the five States is shown in table 9; it covers results from the three methods of summarization mentioned earlier. In general, the drawn-sample figures show some downward bias, whereas those summarized as a mailed survey without followup indicate plus and minus departures from the published data.

Analysis of Drawn Sample

Although the sampling method has proved to be generally sound and has provided overall results with a fair degree of accuracy, several weaknesses in a size-group stratification were apparent in applying that method to horticultural specialty products. The greatest weakness found was in the shift in size of growers from 1956 to 1957. On the basis of a reclassification analysis made for selected products in each State, it is estimated that approximately 25 percent of the drawn sample was out of class because of the change in size

TABLE 10.—*Standard chrysanthemums: Producers, by size, 1956 and reclassified in 1957 (excluding new growers), California*

Size	1956	Reclassified in 1957							
		0	1	2	3	4	5	6	7
1	9	5	3		1				
2	48	11	1	26	10				
3	30	4		1	18	4	3		
4	16	1			1	5	7	2	
5	25	2		1		2	12	8	
6	28	1				2	3	18	4
7	6								6
Total	162	24	4	28	30	13	25	28	10

TABLE 11.—*Carnations: Producers, by size, 1956, and reclassified in 1957 (excluding new growers), Colorado*

Size	1956	Reclassified in 1957							
		0	1	2	3	4	5	6	7
1									
2	7			7					
3	8	2			6				
4	15	1				14			
5	19	1					18		
6	34	1						33	
7	28								28
Total	111	5		7	6	14	18	33	28

TABLE 12.—*Broad-leaved evergreens: Producers, by size, 1956 and reclassified in 1957 (excluding new growers), California*

Size	1956	Reclassified in 1957							
		0	1	2	3	4	5	6	7
1	69	11	56		2				
2	131	11	1	112		6	1		
3	46	1			41		1	3	
4	14	3		1		10			
5	20			2	2		13	2	1
6	24					2	3	11	8
7	36						1	4	31
Total	340	26	57	115	45	18	19	20	40

of producers that occurred between 1956 and 1957.

But this was not uniform between items and States. Tables 10 to 13 demonstrate some of the changes that occurred. Table 11 shows that carnation producers in Colorado do not change much in size from year to year; therefore, they provide a sound sampling base. But standard chrysanthemum growers in California can change their scale of operations rapidly from year to year, as indicated by table 10. Growers of broad-leaved evergreen plant material in California, and citrus and subtropical fruit trees in Florida, tables 12

Table 13.—*Citrus and subtropical fruit trees: Producers, by size, 1956 and reclassified in 1957 (excluding new growers), Florida*

Size	1956	Reclassified in 1957							
		0	1	2	3	4	5	6	7
1	131	18	109	4	--------	--------	--------	--------	--------
2	226	51	19	155	--------	--------	--------	1	--------
3	42	2	3	4	30	2	1	--------	--------
4	22	1	--------	2	--------	15	1	3	--------
5	18	3	1	1	1	1	10	1	--------
6	2	--------	--------	--------	--------	1	1	--------	--------
7	5	--------	1	--------	--------	--------	--------	--------	4
Total	446	[1]75	133	166	31	19	13	5	4

[1] More than offset by new growers (about 100 citrus nurseries added to list in 1957).

and 13, also show a tendency to change operations materially from year to year. The changes shown by these exhibits tend to distort stratum averages rapidly in a predetermined sample.

Another apparent weakness of the drawn sample was found in the effect of new growers entering the business. A fixed sample, often with drawn zeros, adjusts downward as growers leave the business. But this bias is not offset unless all new growers are enumerated and added in independently after the drawn sample has been summarized. The incidence of "zero reports" in 1957 among drawn sample producers was much greater than expected following the complete grower classification survey in 1956.

In analyzing the results of the drawn sample survey, it is apparent that the heavy reclassification of producers between size groups coupled with the "zero report" bias, introduced surprisingly large errors that could not be controlled through the mechanics of a predetermined sample.

Analysis of Mailed Survey Without Personal Followup

While the mailed survey without personal followup was frequently as good as the mailed survey with followup, and often superior to the drawn sample, the chance of a large error was much greater. This is indicated by data for broad-leaved evergreens grown in California and for pompon chrysanthemums grown in Florida. Such errors usually result from estimating, based on average size for the stratum, for very large nonrespondents, usually for growers in stratum 7, in which there is no upper limit to size of operation.

Summary

Although the composite results of the drawn sample method were not discouraging, the totals for some of the individual products in the five States indicated larger errors than were expected, and larger errors than are desirable in handling an operating program. The results of the mailed survey without followup, although they often prove to be satisfactory, can result in substantial errors, even when the universe is relatively large. Because of this drawback, the mailed survey without followup would probably not be satisfactory, even though some economies of operation could be realized.

Considering overall inputs of time and money, it appears that a general mailing—probably four mailed requests—followed by highly selective field followups aimed at larger growers in strata 6 and 7 will produce results of better quality by product and by State than either a predetermined sample or general mailing without field followup. This assumes a size reclassification survey about once every 3 years aimed at growers not cooperating in the program. However, the results of this study do not exclude the possibility of sampling such a universe for other characteristics, which may not demand the same degree of precision desired in estimating the number of plants and value of sales for horticultural products.

Trends in Labor Input and Output in Selected Agricultural Processing Industries, 1947–57

By Imogene Bright

Valid measures of the changing output of the marketing system in comparison with the inputs of resources such as labor are of basic importance in appraising the efficiency of the marketing system, in determining those segments of the system where possibilities for improvement are marked, and in examining a wide variety of other economic questions. Attempts to improve measures of input-output relationships have been beset by numerous difficulties relating to the quality of output, the fact that some output is in the form of service attached to a product rather than a physical commodity, the problems of disassociating inputs of different types of factors, and other questions regarding the nature of inputs. This article reports various methods that can be employed in the measurement of output per unit of labor and suggests the difference or bias that can result when various concepts are used. The methods employed produce findings that give a picture of trends in output per unit of labor input. As further Departmental studies yield improved measures of these relationships, they will be reported.

ONE ASPECT of appraising the efficiency of marketing involves measurements and analysis of movements in output per worker. Current measurements of marketing efficiency published by the Department deal with labor cost per unit of product and with the relationships between cost and price changes for certain other goods and services used by marketing firms. Although the Department has published a continuing series dealing with farm productivity, no such series exists for marketing farm food products.

This article represents an attempt to measure labor efficiency in real terms—output per person and per man-hour—for a few segments of agricultural marketing for which there are sufficient data to permit such estimates. While the data used pertaining to production and to labor inputs have some shortcomings, as will be discussed, the measures of output per unit of input here reported appear to provide good indicators of the general trends during the last decade.

In general, gains in efficiency are reflected in increases in output relative to input. Measures may be developed to determine changes in output in relation to the total of inputs of all factors or to the input of individual factors. While measurements of this kind indicate the change in efficiency of resource use over time, they do not indicate optimum patterns of resource use. Nevertheless, such measures provide a workable basis for determining trends in efficiency. As such, they are useful tools in measuring changes in a given industry over a period of time, and, at least, among those industries in which the pricing system is operating without serious imperfections, they afford a method of comparing changes in efficiency among different industry groups.

The purpose of this study is to examine the extent to which changes in output have been related to changes in one factor—labor input. Six major agricultural processing industries—baking products, dairy products, meat products, canned and frozen foods, sugar, and grain mill products—have been selected for examination. These industries represent a substantial part of agricultural marketing activity, including about a million employees and accounting for approximately $34 billion in value of shipments in 1954. The period covered is 1947 through 1957.

Four Different Indexes Suggested as a Measure of Labor Productivity

For the purpose of measuring output in relation to labor input in selected agricultural processing industries, four different indexes were constructed and are presented in this article. First, an index of output per production worker was constructed (table 1). To incorporate the concept of man-hours of labor and to reflect changes in number of hours worked per week during the period 1947–57, a second index, that of output per production worker man-hour was computed

TABLE 1.—*Index of output per production worker, selected processing industries, 1947–57*

[1947–49=100]

Year	Output per production worker in processing—					
	Bakery products	Dairy products	Meat products	Canned and frozen foods	Sugar	Grain mill products
1947	99	100	103	95	96	99
1948	99	98	100	98	95	98
1949	102	102	97	107	109	102
1950	104	108	100	115	115	106
1951	105	109	101	122	106	109
1952	105	117	101	122	115	111
1953	105	129	101	120	122	116
1954	105	134	104	118	128	115
1955	106	141	112	124	132	116
1956	108	150	111	136	143	116
1957	111	157	111	138	143	121

TABLE 2.—*Index of output per production worker man-hour, selected processing industries, 1947–57*

[1947–49=100]

Year	Output per production worker man-hour in processing—					
	Bakery products	Dairy products	Meat products	Canned and frozen foods	Sugar	Grain mill products
1947	98	99	100	93	94	97
1948	98	98	99	100	97	99
1949	103	104	100	107	110	104
1950	105	110	103	114	113	109
1951	106	112	104	119	110	108
1952	106	121	104	121	117	110
1953	106	133	106	120	120	118
1954	108	141	108	119	126	116
1955	109	146	114	124	129	117
1956	111	159	115	133	140	120
1957	116	168	117	138	141	125

(table 2). A third index which reflected changes in output per worker was constructed. In addition to production workers, it included all sales, clerical, technical, administrative, and professional workers (table 3). Finally, an index was computed on the basis of estimated man-hours worked by all employees (table 4).

Each of the indexes can be used to show a relationship between labor inputs and output, and each has the merit of showing more than the Federal Reserve Board index of production in that it relates output to labor input. Total inputs consist of inputs of land and capital in addition to labor, but only labor inputs are considered in this article.

Each of the indexes incorporates a different concept with respect to input. For example, output is shown in relation to number of production workers as contrasted to number of production-worker man-hours. If the number of production

Table 3.—*Index of output per employee, selected processing industries, 1947–57*

[1947–49=100]

Year	Output per employee in processing—					
	Bakery products	Dairy products	Meat products	Canned and frozen foods	Sugar	Grain mill products
1947	101	102	104	96	97	100
1948	99	98	99	98	95	98
1949	100	100	97	106	108	102
1950	100	103	99	114	114	102
1951	98	100	100	122	102	103
1952	97	106	100	120	110	105
1953	96	116	100	119	117	106
1954	93	118	102	117	122	106
1955	93	124	110	122	126	104
1956	93	132	110	133	137	103
1957	95	138	109	134	136	105

Table 4.—*Index of output per employee man-hour, selected processing industries, 1947–57*

[1947–49=100]

Year	Output per employee man-hour					
	Bakery products	Dairy products	Meat products	Canned and frozen foods	Sugar	Grain mill products
1947	100	102	102	94	95	98
1948	100	98	98	100	97	99
1949	97	101	99	106	108	103
1950	102	105	101	113	113	104
1951	99	103	102	119	105	103
1952	98	110	103	119	112	105
1953	97	119	104	119	115	108
1954	95	123	105	117	122	107
1955	94	129	111	122	124	106
1956	95	139	113	132	136	106
1957	98	146	114	133	135	109

workers did not change but the number of hours worked by these employees changed, the second index would show this concept, whereas the first would not.

When the number of other-than-production workers changes in relation to production workers, as has been the experience during the period studied, increases in output in relation to total number of employees is smaller than for production workers only.

Output in Selected Processing Industries and in Agriculture

Except for bakery products, output has increased in relation to input measured on all four bases. In bakery products, output per employee and per employee man-hour decreased during the period studied. Table 5 shows output per man-hour in United States agriculture from 1947 to 1957. It can be compared with table 2, which

TABLE 5.—*Index of output per man-hour, United States Agriculture, 1947–57*

(1947–49=100)

Year	Output per man-hour
1947	92
1948	104
1949	104
1950	112
1951	113
1952	120
1953	123
1954	127
1955	132
1956	136
1957	143

Agricultural Research Service.

shows output per production worker man-hour in selected processing industries and table 4, which shows output per employee man-hour in the same industries.

Yearly Changes in Output

Tables 6, 7, 8, and 9 show, for each of the labor-input measures, the estimated yearly percentage changes, and they suggest the differences in the output that may be shown by each of the different measures. The estimated average annual rate of change for the private non-agricultural sector of the economy is 2.2, 3 percent for all manufacturing, 2.5 percent for mining, and 2 percent for farming.[1]

Methodology and Limitations of Measurements

The measure of output of the selected food-processing industries used for this article is the Federal Reserve Board's index of industrial production. This index is a measure of the changes in the country's physical output at factories. The index measures physical volume, not value of the output of an industry. In addition, the index does not reflect changes that affect the quality of products, including additional services produced by food manufacturers, nor does it separate secondary products produced by plants primarily classified into the industry described. The production index measures a physical output that is not constant over time in either quality or composition.

The number of production workers and the total number of employees in each of the industries studied are those reported by the Bureau of Labor Statistics. The index of output per production worker was obtained by dividing the index of output by an index of production workers; similarly, the index of output per employee was obtained by dividing the index of output by an index of the total number of employees in the industries specified. To obtain the index of output per man-hour, an index of man-hours was computed using the yearly average number of hours worked weekly by production workers as reported by the Bureau of Labor Statistics and assuming a 52-week year. For technical, clerical, sales and administrative employees, an assumption was made of a 40-hour week and a 52-week year.

Summary and Conclusions

Four possible measures of labor productivity can be computed from data published by the Federal Reserve Board and the Bureau of Labor Statistics: (1) Output per production worker; (2) output per production worker man-hour; (3) output per employee; and (4) output per employee man-hour.

Although the measures presented here offer no explanation for the fact that output as measured in any of these ways has changed, they do show the direction and the magnitude of changes in output relative to labor inputs. One weakness of using output as an indicator of productivity change is that when proportions of the different factors have varied, changes in the ratio of output to one input may reflect substitution of factors as well as changes in overall productive efficiency. Only by relating output to all inputs can it be determined whether there has been a net saving in real costs per unit of output, or, conversely, a gain in productivity.[2]

The factor considered to be most important in increasing output per employee is greater and more efficient capital per worker. Nevertheless,

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[1] Joint Economic Committee. PRODUCTIVITY PRICES AND INCOMES.

[2] Kendrick, John W. PRODUCTIVITY TRENDS: CAPITAL AND LABOR. *Rev. of Econ. and Statis.* August 1956, p. 248.

TABLE 6.—*Yearly percentage changes in output per production worker, selected processing industries, 1948–57*

[1947–49=100]

Year	Bakery products	Dairy products	Meat products	Canned and frozen foods	Sugar	Grain mill products
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
1948	0	−2	−3	3	−1	−1
1949	3	4	−3	9	11	4
1950	2	6	3	7	6	4
1951	1	1	1	6	−8	3
1952	0	7	0	0	8	2
1953	0	10	0	−2	6	4
1954	0	4	3	−2	5	−1
1955	1	5	8	5	3	1
1956	2	6	1	10	8	0
1957	3	10	0	1	0	4

TABLE 7.—*Yearly percentage changes in output per production worker man-hour, selected processing industries, 1947–57*

[1948–49=100]

Year	Bakery products	Dairy products	Meat products	Canned and frozen foods	Sugar	Grain mill products
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
1948	0	−1	−1	8	3	2
1949	5	6	1	7	13	5
1950	2	6	3	7	3	5
1951	1	2	1	4	−3	−1
1952	0	8	0	2	6	2
1953	0	10	2	−1	2	7
1954	2	6	2	−1	5	−2
1955	1	3	6	4	2	1
1956	2	9	1	7	8	2
1957	4	6	2	4	1	4

changes in the ratio of output to total inputs show the joint effect of many separate, though interrelated influences like technical improvements, such as improvements in plant layout, work flow and material-handling procedures; the relative contributions to production of plants at different levels of efficiency; changes in volume of production; the skill, effort and incentive of the labor force; and the efficiency of management.

Gains in output in relation to input make it possible to lower costs of production, which can result in business expansion, lower prices, higher wages or increased profits, or combinations of these results.

The measures presented here permit comparisons between processing industries and show, by comparisons between the index of output per production worker and the index of output per employee, the increasing significance of the increase in number of other-than-production workers. The comparisons between industries indicate the food-processing industries which appear to operate with greatest efficiency, as contrasted with those industries which appear to be lagging. Also, it may be observed that there appears to be an inverse relationship between output per unit of labor input over the past 10 years as reported in this article and the extent to which marketing margins for selected products in these industries have increased. That is, increases in margins appear to have been lowest in those industries where labor efficiency has increased most and highest in those industries where labor efficiency has shown little change.

Table 8.—*Yearly percentage changes in output per employee, selected processing industries, 1947–57*

[1948–49=100]

Year	Bakery products	Dairy products	Meat products	Canned and frozen foods	Sugar	Grain mill products
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
1948	−2	−4	−5	2	−2	−2
1949	1	2	−2	8	11	4
1950	0	3	2	8	6	0
1951	−2	−3	−1	7	−10	1
1952	−1	6	0	−2	8	2
1953	−1	9	0	1	6	1
1954	−3	2	2	−2	4	0
1955	0	5	8	4	3	−2
1956	0	6	0	9	9	−1
1957	2	4	1	1	1	2

Table 9.—*Yearly percentage changes in output per employee man-hour, selected processing industries, 1947–57*

[1948–49=100]

Year	Bakery products	Dairy products	Meat products	Canned and frozen foods	Sugar	Grain mill products
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
1948	0	−4	−4	6	2	1
1949	−3	3	1	6	12	4
1950	5	4	2	7	5	1
1951	−3	−2	1	5	−5	−1
1952	−1	7	1	0	7	2
1953	−1	8	1	0	3	3
1954	−2	3	1	−2	6	−1
1955	−1	5	6	4	2	−1
1956	1	8	2	8	10	0
1957	3	10	1	1	−1	3

AMS Reports Win American Farm Economic Association Awards

The American Farm Economic Association at its recent annual meeting cited two reports published by the United States Department of Agriculture during the past year—Agriculture Handbook No. 141, "Distributed Lags and Demand Analysis for Agricultural and Other Commodities" by Marc Nerlove, and "Carryover Levels for Grains" by R. L. Gustafson. The handbook was one of three awards for the best published research, and the technical bulletin one of the three best doctoral theses. Both reports were issued by the Agricultural Economics Division, Agricultural Marketing Service.

A Device for the Smoothing of Time Series

By Walter A. Hendricks

When sample estimates are plotted in time series, part of the irregularity displayed by the plotted points is chargeable to sampling errors in the individual estimates. This paper describes a method for smoothing the series to eliminate effects of the sampling errors. Fluctuations that can be ascribed legitimately to actual changes in the "true" values are retained.

WHEN ESTIMATES on the same item are made from sample data at periodic intervals, there is usually considerable interest in the change taking place from one survey date to the next. Anyone acquainted with the appearance of time series is familiar with the zig-zag pattern displayed by such successive estimates. From some viewpoints, we might be interested in the smoothest possible trend line that could be drawn on the chart. However, the change shown by this kind of trend line between any two successive dates presents a more idealized picture of actual change than is desired in many instances.

Even though the individual estimates are subject to sampling errors, only part of the average departure of the individual observations from the smooth trend line can usually be ascribed to these sampling errors. Some of the difference is caused by departures of the "true" values from the idealized smooth trend line. But how can one determine how much of the variation of the individual observations about the trend line can be ascribed to true deviations and how much to sampling errors?

To answer this question we need some device whereby the time-series chart can be smoothed only to the extent that effects of sampling errors in the estimates are removed. The difference between two successive adjusted estimates can then be interpreted as a valid estimate of the actual change. This problem was brought into prominence recently when a farm population estimate from a well-known national sample survey showed an extremely large decline from the previous year.

Any qualified statistician would realize that sampling errors in the two successive estimates were probably responsible for part of the observed decrease and that the true decrease was likely smaller than was indicated. This paper presents one device by which effects of sampling errors can be eliminated from a time series when the size of the sampling error is known. It also shows how current estimates can be adjusted for sampling errors.

An Illustrative Series

To illustrate the nature of the problem, consider the following average reported prices per pound paid by farmers for coffee in Georgia on four quarterly survey dates in 1956, 1957, and 1958.

Year	Quarter	Price per pound (cents)
1956	1	97. 6
	2	97. 1
	3	103. 0
	4	103. 0
1957	1	108. 0
	2	104. 0
	3	102. 0
	4	99. 3
1958	1	97. 0
	2	93. 2
	3	90. 4
	4	89. 1

The average price for each quarter has a standard error of about plus or minus 1 cent. This error was computed from the variability of the individual reports received in any one survey and, of course, it varies slightly from one quarter to another. However, the average standard error of about 1 cent is adequate for the computations to follow.

The problem at hand is to smooth the time series of average prices in such a way as to eliminate the effects of the sampling errors. If there were no trends in the average price level during the 3-year period, this smoothing could be accomplished by applying the regression equation:

$$Y-\bar{y}=b(Y-\bar{y}) \tag{1}$$

In this equation, Y is the average reported price for any one date, $\hat{Y}$ is an estimate of the true price, and $\bar{y}$ is the average price for all 12 quarters. The regression coefficient b can be deduced immediately from the observed variability of the 12 values of Y about $\bar{y}$ and the sampling error in any one Y:

$$b=(\sigma_y{}^2-\sigma^2)/\sigma_y{}^2 \tag{2}$$

In this equation $\sigma_y{}^2$ is the variance of Y about $\bar{y}$ and σ^2 is the squared sampling error in Y.

The equation for estimating b takes this form because an observed deviation, $\hat{y}$, consists of a true value, $\hat{y}$, plus an independent random error component. The regression coefficient of $\hat{y}$ on y is given by dividing the expected value of $y\hat{y}$ by the expected value of y^2. It is clear that $E(y^2)=\sigma_y{}^2$ and $E(y\hat{y})=E[(\hat{y}+e)\hat{y}]=\sigma_{\hat{y}}{}^2=\sigma_y{}^2-\sigma^2$.

Unfortunately, the data at hand, and in fact most series of this kind, contain varying trends over time. Equation (1) needs to be modified to read:

$$\hat{Y}-\bar{y}_t=b(Y-\bar{y}_t) \tag{3}$$

This equation takes account of the change in the level of $\bar{y}$ from one point in time to another. Some modification is also required in the computation of b. Equation (2) needs to be modified so that $\sigma_y{}^2$ is now estimated from the average of squared deviations of the form $(Y-\bar{y}_t)^2$.

To use these relationships, we need estimates of $\bar{y}_t$. The problem can be approached by considering the first three points in the series. The average of the first and third reported prices, $(97.6+103.0)/2=100.3$, can be regarded as an estimate of $\bar{y}_t$ corresponding to the second reported price, 97.1. The squared deviation is $(97.1-100.3)^2=10.24$. An estimate of $\sigma_y{}^2$ from that one degree of freedom is given by $(2)(10.24)/3=6.826$.

This follows directly from the fact that when we have three values of Y, spaced at equal time intervals, the two independent degrees of freedom involved can be represented by Y_3-Y_1, which measures the time trend, and $Y_2-\bar{y}_t=Y_2-(Y_1+Y_3)/2$ which measures the effect of the deviations of the three values of Y from this linear time trend. The mean square associated with this second degree of freedom, as computed in analysis of variance, is $(2/3)\ (Y_2-\bar{y}_t)^2$. This mean square is an estimate of $\sigma_y{}^2$.

If computations of this kind are made by grouping reported prices successively by 3's in an overlapping fashion, we obtain the following 10 deviations, each representing the deviation of a given Y from its corresponding $\bar{y}_t$. These deviations are, $Y-\bar{y}_t=$

−3.20
+2.95
−2.50
+4.50
−1.00
+ .35
− .20
+ .75
− .50
− .75

These deviations are not independent of each other because successive groups of observations overlap. However, two-thirds of the average of the squares of the 10 deviations, 3.199, can be regarded as an estimate of $\sigma_y{}^2$. The regression coefficient then becomes

$$b=(3.199-1.000)/3.199=0.687.$$

The computations described are useful in illustrating the theoretical aspects of the procedure. But for practical work, the computations can be set up more conveniently. Any one deviation of the form $Y-\bar{y}_t$ is nothing more than half the negative of a second difference of Y. The computation of the first and second differences of Y is shown in table 1.

The estimate of $\sigma_y{}^2$ can be obtained by squaring the second differences in table 1, computing the average of these squares, and dividing by 6. The regression coefficient b is computed as before.

TABLE 1.—*Computation of first and second differences of Y*

Year	Quarter	Y	$\Delta(Y)$	$\Delta^2(Y)$
1956	1	97. 6	--------	--------
	2	97. 1	−0. 5	--------
	3	103. 0	+5. 9	+6. 4
	4	103. 0	. 0	−5. 9
1957	1	108. 0	+5. 0	+5. 0
	2	104. 0	−4. 0	−9. 0
	3	102. 0	−2. 0	+2. 0
	4	99. 3	−2. 7	−. 7
1958	1	97. 0	−2. 3	+. 4
	2	93. 2	−3. 8	−1. 5
	3	90. 4	−2. 8	+1. 0
	4	89. 1	−1. 3	+1. 5

Table 2.—*Computation of smoothed average prices*

Year	Quarter	$\Delta^2(\hat{Y})$	$\Delta(\hat{Y})$	$\hat{Y}$
1956	1	--------	--------	99. 0
	2	--------	−0. 5	98. 5
	3	+4. 4	+3. 9	102. 4
	4	−4. 1	−. 2	102. 2
1957	1	+3. 4	+3. 2	105. 4
	2	−6. 2	−3. 0	102. 4
	3	+1. 4	−1. 6	100. 8
	4	−. 5	−2. 1	98. 7
1958	1	+. 3	−1. 8	96. 9
	2	−1. 0	−2. 8	94. 1
	3	+. 7	−2. 1	92. 0
	4	+1. 0	−1. 1	90. 9

The process of smoothing the series of quarterly prices now reduces to replacing the original series by a new series in which the second differences of Y are equal to $b.\Delta^2(Y)$. From these adjusted second differences, we can compute the corresponding first differences and values of $\hat{Y}$.

The adjusted second differences of Y are shown in the third column of table 2.

The first differences in the fourth column of the table are computed by cumulative addition of the second differences, starting with a leading term in the column of first differences.

If we represent this leading term by *d*, the 11 first differences are:

$$
\begin{array}{l}
d \\
d+4.4 \\
d+\ .3 \\
d+3.7 \\
d-2.5 \\
d-1.1 \\
d-1.6 \\
d-1.3 \\
d-2.3 \\
d-1.6 \\
d-\ .6
\end{array}
$$

The estimate of d is derived by imposing the condition that the sum of these 11 first differences must be equal to the difference between the first and last values of Y in the original data. This gives $11d-2.6=89.1-97.6$ or $d=-0.5$. Starting with this value of *d*, it is possible to compute the 11 first differences shown in the fourth column of table 2.

The adjusted values of Y shown in the last column of the table are obtained in similar fashion by cumulative addition, starting with a leading term in that column:

$$
\begin{array}{l}
\hat{Y}_o \\
\hat{Y}_o-0.5 \\
\hat{Y}_o+3.4 \\
\hat{Y}_o+3.2 \\
\hat{Y}_o+6.4 \\
\hat{Y}_o+3.4 \\
\hat{Y}_o+1.8 \\
\hat{Y}_o-\ .3 \\
\hat{Y}_o-2.1 \\
\hat{Y}_o-4.9 \\
\hat{Y}_o-7.0 \\
\hat{Y}_o-8.1
\end{array}
$$

The estimate of $\hat{Y}_o$ is obtained by imposing the condition that the sum of the 12 values of $\hat{Y}$ must equal the sum of the 12 values of Y. This gives $12\hat{Y}_o-4.7=1183.7$ or $\hat{Y}_o=99.0$. Starting with this leading term, the values of $\hat{Y}$ in the last column of table 2 are computed by successive addition of the appropriate first differences in column 4.

Application to a Current Estimate

A reported average price for the first quarter of 1959 was not yet available when this paper was written. But for purposes of illustration, suppose it was reported at 85.0 cents.

When this observation is included with the original series of data, the first difference corresponding to that date is:

$$\Delta(Y)=85.0-89.1=-4.1.$$

The second difference is:

$$\Delta^2(Y)=-4.1-(-1.3)=-2.8.$$

The adjusted second difference is:

$$\Delta^2(\hat{Y})=(0.687)(-2.8)=-1.9.$$

The corresponding first difference is given by adding this figure to the cumulative total in the fourth column of table 2:

$$\Delta(\hat{Y})=-1.1-1.9=-3.0.$$

The adjusted average price is then given by adding this first difference to the last adjusted price in the last column of table 2:

$$\hat{Y}=90.9-3.0=87.9.$$

In other words, if the reported average price for the first quarter of 1959 was 85.0 cents, the best estimate of the actual price on that date would be 87.9 cents. In terms of change from the preceding date, the decrease would be 3.0 cents rather than the 4.1 cents observed in the raw data.

Book Reviews

A Survey of Marketing Research: Organization, Functions, Budget, Compensation. American Marketing Association, Chicago. Loose leaf, 103 pages. 1959. $10.00.

THIS BOOKLET presents the results of a mail survey regarding the place of marketing research in American business in the United States and Canada. Questionnaires were sent in April 1957 to the 2,892 firms represented by members of the American Marketing Association and to 575 additional firms belonging to other national associations. With two followup requests, the total response was 39 percent. A description of some of the results follows.

Marketing research departments are more common in large firms than in small ones. Of the largest firms, for example, those with annual sales of more than $500 million, 93 percent had formal departments. In addition, 5 percent of these large companies had one person assigned to marketing research. On the other end of the scale were firms with annual sales of less than $5 million; 30 percent of these had formal departments, 28 percent one person assigned, and 42 percent no one assigned. It is pointed out, however, that companies without specific assignments may have sales managers, advertising managers, or others not explicitly engaged in research who participate in marketing research to some extent.

All told, some 60 percent of the companies reporting (excluding market research and consulting firms) had formal market research departments. The incidence was highest in advertising agencies and in publishing and broadcasting firms (72 percent) and lowest in retailing and wholesaling companies (46 percent). Companies having no one assigned to research included a disproportionate share of retailers and wholesalers (36 percent).

The titles of the charts and tables included in the booklet pretty well tell the story:

"Advertising, publishing, and broadcasting firms are highly organized for marketing research even in smaller firms" (chart 4).

"Agencies and media have the largest formal marketing research departments" (5).

"Number of new departments formed in successive 5 year periods" (6). This title is not fully informative, but the chart shows a rapid growth beginning with the period "before 1918." Almost six times as many marketing research departments were organized (273) between 1953 and 1957 as the number existing 20 years before.

"Media and advertising agencies formed research departments earlier" (7).

"Marketing research managers most commonly report to sales or marketing executives" (table 2).

Following is a section on marketing research budgets. In 1957, manufacturers spent more than 70 percent of the total spent for marketing research, with consumer goods offering a more prominent position than industrial goods. Advertising agencies, together with publishers and broadcasters, spent about 20 percent of the total; while retailers and wholesalers spent only 2 percent. "Marketing research budgets are a fraction of 1 percent of sales for manufacturers and decline in percent as size (of business) increases (chart 10), agency and media budgets are larger . . . (11 and 12), manufacturers of consumer goods spend more of their budgets for outside research (table 3)."

Other topics covered by charts, tables, and brief narrative accounts are The Subject Matter of Research, and The Compensation of Marketing Research Personnel. An appendix contains a few additional tables, together with reproductions of the letter and questionnaire mailed.

The many subjects of research reported include development of market potentials, share of market studies, determination of market characteristics, sales analysis, studies of market changes, establishment of sales quotas and of sales territories, store audits in test markets, studies of channels of distribution and of distribution costs, studies of "deals" and premiums, methods of paying salesmen, personnel requirements, export markets, potentials of new products, competitors' products, product testing and packaging research including design or physical characteristics, short-range forecasting, long-range forecasting, business trends, profit analysis, plant and warehouse locations, use of projective techniques and "motivation" research, copy research, and media.

The mean compensation of directors of marketing research increases with the number of years of marketing research experience, and with the size of the company and the size of the department. The best paid directors are in advertising agencies and among publishers and broadcasters; the poorest paid are in retailing and wholesaling. Statisticians rank higher in salary than analysts but below senior analysts. Women receive less pay than men at all levels of activity.

From appendix tables, it may be noted that the modal group for marketing research directors in manufacturing companies falls in the 5- to 9-year category in terms of marketing research experience; but in marketing research and consulting firms and in advertising agencies, it is in the 15-year-plus category.

Robert M. Walsh

◆

Planning of Experiments. By D. R. Cox. John Wiley and Sons, Inc., New York. 308 pages. 1958. $7.50.

IN DESIGNING an experiment with a small total number of experimental units, an arrangement may be obtained as a result of the randomization, which is unsatisfactory. For example, the random arrangement may fit in with a potentially meaningful pattern in the experimental material. A discussion of ways of dealing with this situation is one of several special features of this elementary but careful presentation of the statistical aspects of experimental design.

General concepts and the classic designs of randomized blocks and Latin squares are described in chapters 1 to 9. Later chapters introduce more advanced subjects, such as incomplete blocks and fractional replications. In addition to randomization, other topics of interest include a discussion of the different purposes for which observations may be made, and the relation of covariance to randomized blocks and to the calculation of adjustments. Considerable attention is given to basic ideas about factorials with specific discussion of different kinds of factors that can occur in this type of experimentation.

Writing for nonstatisticians, the author has attempted to present a basis for experimental design that is intuitively acceptable. Detailed methods of statistical analysis receive only incidental attention. A few sections of the book are argued rather closely and are not easy reading, but for the most part no specialized knowledge is required to understand it. Carefully chosen examples from several fields of application are used throughout the text to illustrate specific points under discussion. The examples are usually set off from the main text, thus enabling the reader to consider them or not as he wishes.

Although supplementary references on statistical analysis would usually be required in actual experimental work, *Planning of Experiments* is well written, and can be recommended as an excellent reference work for persons interested in a simple but fundamental presentation of the statistical aspects of experimental design, either as a background for possible use of this tool, or as an aid in the evaluation of work in which formal design has been used.

Therese Kelleher

Econometric Analysis for Public Policy. By Karl A. Fox. Iowa State College Press. 1958. 288 pages. $4.50.

TWO GROUPS of economists, the mathematically inclined and those interested in public policy, are likely to be attracted by the title of Professor Fox's book. Only the former group is likely to see it through, however, as it is immediately apparent that a good deal more effort is spent on the intricacies of econometric analysis than on public policy applications.

But the author does not neglect public policy applications—he states a hopeful credo in the preface to help sustain those econometricians who despair at the gulf between their models and the public policy decisions that might have been, but apparently were not, influenced by them. Speaking of economic analysis for policymakers, Fox states that "As time goes on, such studies tend to enrich the thinking of administrators, legislators, and leaders of public opinion. . . ." I believe he is right in this, and has himself made important contributions to the progress made so far.

The book is in two parts, the first entitled "The Analysis of Demand." Here the author is concerned with demand estimates, some of which are used in models of the economy presented later. The extensive review of the literature in chapter 1 will be welcomed by students of demand analysis, as will the chapters on commodity demands and demand structure that make up the rest of part I. But as most of the work in this part has appeared before and has merited Fox's well-deserved credit, it is fair to say that the contribution of the present volume is largely to bring the work between two covers and hence more readily available. I do not believe that anything new is added on the question of the "rightness" of simultaneous- or single-equation methods in demand analysis situations.

In part II, Fox uses demand estimates derived in part I, and other coefficients, to implement both simple and complex economic models. Many of the examples are somewhat dated, suggesting that the author intends this section more as a manual on procedure than as a guide to current policy. Chapters 8 and 11 are well suited to such a purpose; they provide simple techniques for analysis of specific short-run problems. Chapters 9 and 10 present Fox's pioneering work in spatial equilibrium analysis of the livestock-feed economy, and chapter 11 is a critique of the Klein-Goldberger model of the U.S. economy. All have appeared earlier in essentially the same form.

If there is a central idea in part II, it is that econometric models as inclusive as data allow are useful in preparing for public policy decisions. A last-page endorsement of continued work on such models, using various statistical formulations and synthetic models as well, is not unexpected.

I wish that Dr. Fox had said more about the task of making such analyses felt in public policy. Clearly, the lines of communication between economists producing simultaneous equation models of the U.S. economy, and the policymakers, are long and poorly connected. I am not sure that there are many econometricians who are making themselves heard and understood by policymakers. Rather, their work becomes useful to intermediaries who ultimately communicate with men at the policy level.

Not all will agree with the author's statement following page 288 that "The economist can be most valuable to the policymaker if he maintains his competence and perspective by carrying on a research program in the areas in which his advice is sought; if he sits constantly at the policymaker's right hand, he is likely to become an administrative assistant rather than an economist."

Surely an economist's research program must be beyond "areas in which his advice is sought." And why should one worry too much about becoming to some extent an administrative assistant so long as he is effective in promoting the public interest? Being an economist as such is pleasant, but there are more important tasks to be done.

I recommend this book to those who want a ready reference on demand analysis or who wish to have the author's many journal articles under one roof. But the reader should expect no ready-built bridges between econometric analysis and the making of public policy.

John A. Schnittker

Introduction to Agricultural Economic Analysis. By C. E. Bishop and W. D. Toussaint. John Wiley and Sons. New York. 258 pages. 1958. $5.25.

THE AUTHORS, Bishop and Toussaint, have set themselves a difficult goal and have succeeded in reaching it. They have written a modern, readable text for undergraduates who are familiar with agriculture but are having their initial exposure to economic methods and analyses. Briefly, the authors range over the field of agricultural economics, keeping the level keyed to the "nonmajor" student who desires a collateral course but lacks a basic grounding in theory and mathematics. In one substantial but pleasant dose the book presents opportunity to grasp many of the very current ideas and techniques of economic science.

Dogmatically, and at the risk of sounding *ex cathedra*, this should become a standard text. It is head and shoulders above most of its competitors. Moreover, for graduate students and professional workers, it will serve as a concise, highly pertinent refresher. The book describes, explains and teaches, a remarkable achievement in itself—there are no bewildering or breathtaking *tours-de-force* at the expense of the general student. The authors have permitted no excursions into other fields of economics and the reader is firmly but gently kept at the task at hand.

Charts, graphs, and empirical examples are used liberally throughout the book. These tools help to display theory and to make the transition to practical problems. Modern, cogent situations are formulated to maintain interest and coincide with other studies and reality. Concentration on budgeting and accounting at the firm level is avoided and emphasis is placed where it should be, on true economic analysis. This latter approach, although unorthodox, is not unduly complicated, and it is highly commendable in view of similar works. For a book of this type, some might criticize the lack of student problems.

The book is divided into four parts: (1) Introduction, (2) Production and Supply, (3) Consumption and Demand, and (4) Economic Progress. It is well indexed and adequately documented. Most of the leaders and pioneers in this area are discussed and their contributions amplified on a consistent level. It is truly a heroic effort, despite the suspicion of professional heresy in omitting any reference to J. D. Black.

In the first part, one might question somewhat the terseness of the authors. In less than 30 pages, the economic organization of society is covered, agriculture is fitted neatly into its slot, and the basic role of the firm is described.

As one would expect, the section that deals with production and supply occupies the largest part of the book, and this is the most rewarding portion. The writers do an outstanding job of presenting production functions, diminishing returns, product and cost curves, and, astoundingly enough, a glimpse of input-output analysis. The practical examples given cover a wide variety of production situations, avoiding the common error of parochialism. The additional discussion of the firm included is well integrated with the primary subjects of the first and second parts. The text moves easily back and forth between micro- and macroeconomics at this stage. Uncertainty, risk, and decision making are well related on a nongraduate level.

Consumption and demand introduces the reader to such highly diverse concepts as price and income elasticity (in the reviewer's opinion, the most difficult of all concepts for the beginner), changes in demand, international trade, the factors of price change over time, and parity. A great deal is accomplished in a very few pages, and needs to be read to be appreciated.

The last part deals with changes and innovations in the economic and technical picture, real and estimated, and shows how prices and progress affect both the family farm and the entire demand-supply relationship. Problem areas within agriculture are discussed, going from the general to the particular, from poverty to geographic location of low-income farms.

The reviewer unhesitatingly recommends this book. It is well worth the time of anyone interested in agriculture or farming. The style, pleasant and painless, should not becloud the objectivity of the authors. They are simply superior writers with a thorough understanding of the subject and a definite goal in mind.

William W. Addison

Microeconomic Theory—A Mathematical Approach. By James M. Henderson and Richard E. Quant. McGraw-Hill Book Co., New York. 283 pages. 1958. $7.50.

IF ONE IS INTERESTED in a rigorous, mathematical restatement of orthodox text book price and firm theory, this is definitely a book to consult. This, however, is the whole of the contribution of this text, and one had better not tackle it unless he is already very well read and up-to-date, at least to the extent of a senior undergraduate reading for honors at a college that is noninstitutional in bias.

This book needed to be written, if only for graduate students preparing for their Ph. D. examinations. Aside from this rather limited market, its usefulness is likely to be small. There are no advances of import in the theory as such, and the strict, terse mathematical formulations cause a considerable loss in conviction. The theory of price is like a beautiful mannequin in a fashionable store window. When stripped of its clothes—the necessary verbal hedging and qualifications—the mannequin is perfectly proportioned but no longer beautiful or convincing. After all, we really cannot explain the rationale of consumer preferences satisfactorily, and 56 equations cannot change this fact. The book is written for those who already know the qualifications and reservations—it is sort of a guide to economics for economists.

All subjects of "microeconomics" are covered, including linear programming, theory of games, and the input-output system. However, the discussion of these and other specific tools of analysis is so short and concise as to be of value only to one who already has the basic knowledge and needs only refreshment.

This review is critical in tone not with respect to substance, but only because the reviewer believes that the market for and usefulness of a book of this kind is limited. The layman or practicing economist who is interested in what the science has to offer in price theory can better find out through Boulding or Steigler. The authors have done a brilliant job in restating microeconomic theory in mathematical terms. The question remains, Why?

William A. Vogely

Economic Forecasting. By V. Lewis Bassie. McGraw-Hill Book Co., New York. 702 pages. 1958. $8.75.

IN THIS reviewer's judgment Bassie's book on economic forecasting is the best there is. Contrary to the usual textbook that serves as a basis for a course in economic forecasting, most of Bassie's book is not devoted to a discussion of business cycle theory and a minute description of previous business cycles. Rather, it starts with the basic tools of the modern forecaster—the National Income Accounts—and shows in practical fashion how to use the expenditure-income flow analysis to provide an appraisal of where the economy is heading. The discussion of the materials available for the analysis, the strategic points to consider, and how the results can be used in terms of public policies or for specific industry forecasts are all detailed and clear.

Professor Bassie is no newcomer to this field. Beginning in the late 1930's, he was a Government forecaster for various agencies including the Federal Reserve Board and the Department of Commerce. Since 1948, he has been Director of the Bureau of Economic and Business Research at the University of Illinois. Further, he is no stranger to agricultural economists, having appeared at several of the Annual Agricultural Outlook Conferences in Washington.

In his most recent appearance in the fall of 1957, when the recession was beginning to take shape, Bassie emerged as the "great pessimist" predicting a substantial and deepening decline in economic activity. That Bassie was wrong in this instance is no reflection on his book. Few, if any, forecasters are always right. But he knows his tools for economic forecasting, and he has presented them well for novice and experienced forecasters alike.

Nathan Koffsky

Taxation of Agricultural Lands in Underdeveloped Economies. By Haskell P. Wald. Harvard Law School International Program in Taxation, Cambridge. Harvard University Press. 231 pages. 1959. $4.50.

WHATEVER THE CONDITIONS may be that set a nation on the path of economic development, there is little doubt that an appropriate tax system is among them. A repressive or inadequate tax system can easily discourage incipient growth. If wisely designed, however, tax measures can provide positive economic incentives and serve as an effective tool of national economic policy.

The Harvard Law School International Program in Taxation, sponsor of the study reported, has done much to improve our understanding of the role of taxation in economic development, notably through its publication of the Papers and Proceedings of its 1954 Conference on Agricultural Taxation and Economic Development. The present study is an outgrowth of that conference, which, in the author's words, "pointed out the problems and shortcomings of existing land taxes and underscored the large potential contribution a more effective system of land taxation might make to the financing of economic development in many countries."

As its subtitle indicates, this book is both a survey of existing land tax systems in various newly developing economies and a guide to policies for reform. In the first three chapters, the major systems of land taxation are described. The analysis draws heavily on the earlier conference volume, and includes a comprehensive and useful classification of the different types of land taxes. Part 2—Major Policy Guides—opens with a discussion of the theoretical basis for land taxation, and continues with two chapters on equity considerations, and one each on the relation of land taxation to agricultural development, economic policy regarding the role of agriculture in the total national economy, and tax administration. Part 3 contains specific suggestions for reform.

In the early stages of a nation's economic development, Wald points out in his introduction, agriculture is the dominant industry, and taxes on agricultural land are often the only promising means of tapping, in the required large amounts, the income of the agricultural sector. An effective land tax is thus of utmost importance to a country's economic growth. Yet few nations have succeeded in making land taxes a productive fiscal device. In 12 of the 21 nations for which data are given, the land tax produces 5 percent or less of the total tax receipts. Moreover, Wald tells us, there is ample evidence that land taxes have been losing ground steadily as a revenue source.

This failure to keep pace is attributed in large part to the inelastic character of the yield of most land taxes. The problem is most acute during periods of economic growth and inflation, such as occurred during and after World War II.

Land taxes that are levied on gross produce and collected in kind avoid this problem, and evidence indicates that nations that use such a tax (Mainland China and the Republic of Korea) stand at the top of the list in terms of the land tax yield as a percentage of total tax revenue. Administrative problems, however, argue against general adoption of this form of land tax, and Wald's general recommendations for improving revenue flexibility emphasize improved measures of the tax base, through a periodic land assessment supplemented by short-run adjustments for changes in agricultural prices or production.

A more urgent problem than revenue rigidity, in Wald's view, is the need to reform the land tax base "so that the tax rests on a sound land classification system and accords as closely as possible with presumptive net income." To this end, he gives attention to various possible techniques of land classification applicable to countries in various stages of development. His third proposed reform concerns the need to "personalize" the land tax by adapting it to the individual's economic circumstances.

The reasoning supporting these recommended reforms is convincing. It is based on a penetrating analysis of the theoretical issues in land taxation. If there is any weakness in Wald's argument, it probably is that he assumes a higher degree of administrative skill than is likely to exist in most underdeveloped countries. When one observes how rarely rural assessors in the United States employ such basic tools of assessments as soil classifications and land use capability maps, one may well despair of the prospects for adopting these methods in less developed nations. And this is not to mention such added refinements as his suggested tax adjustments for hired labor and personal allowances for the taxpayer's marital and dependency status.

It is fortunate, however, that Wald does not limit his discussion to those measures that are immediately feasible in primitive circumstances, for what he has given us is a modern statement of the general principles of land taxation. In particular, his chapters on land tax rationale, on shifting and tax capitalization, and on considerations of interpersonal equity have wide applicability. In fact, many of the issues he raises concerning land tax policy deserve the attention of those concerned with the American property tax—for example, his contention in favor of instituting an *in personam* concept of property taxation for the time-honored *in rem* doctrine.

Standing almost alone in its field, this book is essential for anyone concerned with public finance problems in underdeveloped economies. More broadly, Wald's excellent discussion of basic land tax principles commends this book to the attention of the general student of taxation and land economics.

Frederick D. Stocker

◆

The Staple Food Economies Of Western Tropical Africa. By Bruce L. Johnston. Stanford University Press. 306 pages. 1958. $6.00.

RECENT AWAKENING and developments in Africa have been unfolding so rapidly that the rest of the world is left groping frantically for adequate understanding and adjustment. This is particularly true of the United States, where active interest in world affairs appears to be aroused only in response to crises; thus the demand for information about Africa has become keen. Unfortunately, authentic information on the great tropical segment—the African heart—is still inadequate. It will be years before expanded research will yield a reliable body of knowledge on basic aspects of prevailing social and economic organizations in tropical Africa.

Promising beginnings have been made by various institutions and individuals, and Dr. Bruce Johnston's book is a welcome and outstanding addition. He applied himself to the basic subject of staple food crops in the western, and larger, portion of tropical Africa.

The importance of these crops (millets and sorghums, maize, rice, manioc, yams, cocoyams, sweetpotatoes, and plantain) derives from the fact that, even more than the publicized export crops of cocoa, coffee, peanuts, and palm oils, they permeate the agricultural pattern and dominate the African diets.

The result is a thorough and comprehensive book, which in 10 chapters and appendix tables covers all major aspects of the subject. The role of the staple food crops is analyzed in relation to economic development and the diet of the people; their distribution patterns are delineated and interpreted in terms of their own characteristics, the physical environment, economic factors, and cultural-historical influences; and prospects for changes in food consumption and production are appraised. Highly instructive also are the many tables and maps on climatic features, vegetation zones, crop distribution, population distribution, production and trade of staple crops and their relative caloric yields, nutrient composition and labor requirements, and other features that complement the text.

Agricultural economists will find the author's discussion and conclusions in the chapter, "Economic Factors in Distribution," most interesting. For example, in appraising the relative yields of the various staples in West Africa, the author ranks them against an index of "caloric yield per hectare." Millet-sorghum ranks lowest and manioc highest. But when considered from the angle of total area production, millet-sorghum ranks highest and manioc second.

Taking labor requirements as a basis for comparison, the author shows that in the forest zone of the Belgian Congo, manioc and plantain required the smallest number of total man-days per ton, and rice the largest. He shows similar comparisons for cost per 1,000 calories, and again manioc and plantain rank lowest. The author's analyses of relative prices and nutritional values of these staples are equally enlightening.

Agriculturists and economic geographers will be particularly interested in the three chapters on the physical environment, geographical distribution, and characteristics of the staple crops. Here is presented a detailed picture of the dominant physical factors in the area. This serves as a background for the maps and discussion on the patterns of crop distribution. Thus millets and sorghum emerge as dominant crops in the region, with rice leading in five territories and maize leading in one. Manioc is a close second, followed by yams.

Those interested in nutrition, trade in food items, and agricultural development in Africa will find the three final chapters rewarding. The relative positions of the starchy staples in African diets are shown for various regions. Methods of preparing food and seasonal variations in consumption are discussed. The author then proceeds to explain the factors that are likely to change the patterns of food production and consumption.

Wisely, Dr. Johnston approaches this complex and dynamic field with caution. Nevertheless, he arrives at interesting conclusions. For example, he sees "a growth in consumption of rice and wheat flour," . . . "that manioc is likely to increase in importance," . . . "a significant growth of technical knowledge of the means of raising agricultural output and productivity," and "that the expansion of agricultural output in most if not all of western tropical Africa will keep pace with the growth of demand."

Afif Tannous

Water Resource Development: The Economics of Project Evaluation. By Otto Eckstein. Harvard University Press. 1958. 300 pages. $6.50.

In 1950 the Subcommittee on Benefits and Costs of the Federal Inter-Agency River Basin Commitee published its *Proposed Practices for Economic Analysis of River Basin Projects.* Until 1958, this "Green Book" stood as the only comprehensive treatment of the methodology of benefit-cost analysis. Not that progress ceased in this important field—after 1950 many excellent articles and books dealing with segments of the problem appeared. But 1958 was a banner year for benefit-cost theory. Eckstein's book and its companion piece, Krutilla and Eckstein's *Multiple Purpose River Development*, appeared almost concurrently with *Efficiency in Government Through Systems Analysis* by Ronald McKean. These works attempt to synthesize previous approaches and apply the developed criteria to examples of Federal water-development projects. All make important original contributions.

Professor Eckstein grapples manfully with the problem of criteria: Should benefits be maximized in terms of local resources, that is, should each river basin or watershed be developed so as to maximize net benefits; or should we consider as given a certain quantity of Federal funds and maximize potential benefits from its investment? While recognizing exceptions and modifications, he settles on the "budget constraint" as the most generally applicable approach.

Should the benefit-cost ratio or the rate of return be maximized? Eckstein demonstrates how the ranking of projects differs between the two methods. Capital intensive projects (construction costs high relative to annual costs) are favored by the benefit-cost ratio while capital-extensive projects are favored by the rate of return. Although he shows a predilection for capital-extensive projects (they commit fewer resources irrevocably), he recognizes that it is the capital-intensive project that typically is relegated to public investment. Also, with the assumption that rationing of capital via the budget is perpetual and fluctuations in its severity cannot be foreseen, he concludes that "if, in each year, those projects are started which have the highest benefit-cost ratios, and if the marginal increment of each project has a benefit-cost ratio equal to the cutoff ratio of the program in the period, then the total return on Federal expenditures will be maximized."

Eckstein's forte is the treatment of risk and time. He demonstrates lucidly the differential effects on the benefit-cost ratio of different types of projects (different longevities, different degrees of capital intensity, different ratios of private to Federal funds), of the use of limits on the time period of analysis (as required by Budget Bureau Circular A47), and of the use of one interest rate for private and another for Federal costs. His major point, however, is that the interest rate on Government bonds may account for time preference but makes little, if any, allowance for risk or that the social cost of funds raised through taxes ranges between 5 and 6 percent. (This latter conclusion was arrived at by an empirical study, the results of which were published in the Krutilla and Eckstein books.) But he points out that through the political process society may demonstrate a lower discounting of distant future benefits than does the average individual, and concludes that the use of a 5- or 6-percent interest rate would discriminate against those projects that are best suited to public investment. He recommends using a lower interest rate and setting a minimum acceptable benefit-cost ratio, say 1.4, which would insure an average rate of return of about 6 percent on the Federal investment.

In addition, he treats the problems of price levels, cost of land, indirect benefits, cost allocation, reimbursement, cost-sharing—in fact, the gamut. After establishing his criteria, he applies them to current practices in the evaluation of flood control, navigation, irrigation, and electric power development, using selected projects as examples. He finds agency procedures wanting on various counts and makes recommendations for improvement.

It has been pointed out that although decisions for public investment in water development are made in the political arena, the arguments are almost always economic. Benefit-cost analysis, imperfect as it is, does eliminate some of the specious rationale. Such works as Professor Eckstein's help to reduce the imperfections in the analysis. Anyone working in the field should not only read this volume, but study it.

Robert C. Otte

Multiple Purpose River Development. By John V. Krutilla and Otto Eckstein. Johns Hopkins Press, Baltimore. xiv, 301 pages. 1958. $4.50.

THE ECONOMICS of water-resource development has received progressively greater attention during the past decade and a number of analysts have questioned the procedures and standards followed by Federal agencies in the formulation and economic evaluation of water-control programs. A few analysts have attempted to develop a conceptual model for water-resource development oriented to considerations of public welfare. *Multiple Purpose River Development* is one of three recently published books in this area. In a sense, these books culminate this decade of effort to develop an appropriate and rigorous system of economic analysis for use in the formulation and evaluation of public resource development programs.

The twofold objectives of *Multiple Purpose River Development* is indicated by its two-part organization. Part 1 is devoted to the development of economic concepts and the construction of a procedural apparatus. Part 2 is concerned with application of the theoretical foundation to three individual river-basin developments, the results of which are presented as case studies.

The initial focus in part 1 is centered on the unique characteristics of river systems and of their utilization and development that set them apart from other types of economic resources and their use. The authors ably develop the concepts of "interdependence of water control projects in a river system and indivisibility of river waters;" and they argue correctly that these characteristics of river-basin development distinguish them from other resource use as assumed in traditional competitive theory.

Included also in part 1 is a careful statement of the concepts of economic efficiency and a review of traditional economic theory. The explicit welfare orientation of the discussion enhances its value and potential acceptance by many planners who have been reluctant to accept economic criteria in public development programs.

Chapter IV, "The Social Cost of Federal Financing," represents a distinguished pioneer attempt to measure the opportunity cost of public funds used in the construction of water-resource projects. This chapter will likely provide a subject for further discussion. It may have greater impact on water-resource planning and evaluation than any other chapter in the book, or perhaps any other recent work in the field of benefit-cost analysis.

The authors argue effectively that the interest rates used in the economic analysis of public projects should conform to the concept of opportunity cost. In so doing, they reject the widely held belief that the interest charge should represent the money cost of obtaining funds by the Federal Government.

In rejecting the public borrowing rate and the rationale commonly used in its support, they argue that "the American economy does not fit the competitive model closely enough to permit the use of so simple a procedure. The substantial risk premiums on the terms on which business can borrow and the rationing of credit to some businesses and to most consumers, preclude the existence of a unique rate of interest and prevent consideration of any single actual rate as a measure of the social cost of capital."

Authors Krutilla and Eckstein conclude, also in this chapter, "that since the market cannot be consulted for the price of capital, as competitive theory would suggest, it is necessary to derive an estimate by more complicated empirical procedures which take account of some of the complexities of the process by which savings are actually channeled into investments."

In approaching the first problem, a question is raised as to the source of additional tax revenue for project development, or conversely, the recipients of benefit from a reduction of taxes. Recognizing that the answer would depend upon the type of tax increase or reduction put into effect, the authors develop alternative models based on: (1) A change in tax levy that would have a relatively great effect on consumption; and (2) a change that would have a relatively greater impact on investment.

For each of the two assumed tax changes, the relevant interest rates for a large number of consuming and investing sectors of the economy are estimated and a weighted average is computed. On the basis of their calculations, the authors conclude that the social cost of funds derived from the two types of tax changes would range from 5.44 to 5.79 percent and hence that the opportunity or social cost of Federal financing is in the range of 5 to 6 percent, as opposed to the 2½ percent rate commonly used in evaluation of public projects.

One of the significant and interesting conclusions of the application of the analysis to selective case studies in part 2 is that the interest rate actually used in project evaluations is a primary determinant in the formulation of river-basin projects. In analysis of the Hells Canyon case, for example, the use of a 2½-percent interest rate would lead to the conclusion that the one large dam on the Snake River (Hells Canyon), which is proposed as a public development would be more efficient but that the use of a 5 or 6 percent interest rate would dictate a somewhat smaller scale of development.

In summary, this book points a finger to one of the most crucial questions on water-resource development and public policy. If the authors are correct in their conclusions on interest rate, it may be fairly concluded that many projects being justified and constructed may not be wholly in the public interest. The analysis leads also to the conclusion that the scale of projects currently being planned and constructed is far in excess of a scale of development that would be economically justified. This and similar conclusions reached by other analysts outside the Federal Government should lead to a careful reappraisal of the interest rate standards now used by water-development agencies of the Federal Government. The implication of the conclusions of this book may also be as far-reaching in other areas of public resource development as they are for water-resource programs.

William A. Green

Linear Programming Methods. By Earl O. Heady and Wilfred Candler. Iowa State College Press. 1958. 597 pages. $5.95.

FINGERS were the first digital computers. The only really new thing about an electronic calculator is its fantastic speed. It does simple arithmetic literally at lightning speed. This places a premium on the development of such formal techniques as linear programing, input-output analysis, and the theory of games. These are high-powered analytical vehicles capable of using the speed.

Until recently, the rapidly growing literature on linear programing was scattered widely in brief articles and papers, many of them written in highly technical language. This book is the second to bring a significant part of this scattered material into one volume and to present it in less technical form for the use of economists. The other book, *Linear Programming and Economic Analysis*, by Robert Dorfman, Paul A. Samuelson, and Robert M. Solow (McGraw-Hill Book Co., Inc. 1958) was reviewed in the July 1958 issue of this journal.

Dorfman, Samuelson, and Solow emphasize the relationship of linear economics to traditional economic theory. Heady and Candler stress the formulation and solution of problems. The two books are thus complementary, and both should be in the working library of aspiring programers.

The special merit of the Heady-Candler volume for agricultural economists is that the explanation of methods and procedures is well illustrated with examples from practical agricultural problems. The mathematical portions of the exposition are simple and straightforward. The presentation is helpful for those who are still learning to walk on programing paths, but it will prove particularly useful also to those who have learned to walk and are ready to get out on the electronic freeway and operate at high speed.

The 17 chapters in the book fall naturally into 2 parts. The first part, chapters 1 through 10, contains a consistent, logical development of linear programing from basic concepts through the computational procedures for solving mill-run problems.

The second part of the book includes the remaining 7 chapters and is more technical. These chapters cover the elements of matrix algebra and a number of types of analysis related to linear programing. Among these are input-output analysis, theory of games, and nonlinear and risk programing.

The stated purpose of the authors is to write so as to place the tool of linear programing in the hands of those who are not primarily mathematicians. The first part of the book, especially, is intended to reach graduate students and advanced undergraduates as well as established economists.

The chapters in the second part are useful stepping stones for those who want to go further into explanation of method. Chapter 11, Elements of Matrix Algebra, is an excellent introduction for those who have not explored this area of mathematics. The chapter on Theory of Games and the one on Nonlinear and Risk Programing are well worth reading.

Many of the books issued by the Iowa State College Press would benefit from more careful editing to avoid noticeable solecisms and slips in syntax. Some in this book are sufficiently intrusive as to detract from the general clarity of the exposition. For example, the sentence in the preface that reads, "These chapters provide the knowledge for solving most of the practical problems which arise in agriculture and other industries," is not sufficiently explained and may be misunderstood. There are other statements that may leave the casual reader with the impression that the authors have unconsciously allowed the problem to be obscured by the method in their vision of linear programing.

The truth is that in solving them, we have always faced economic problems of the kinds discussed and we have used and will continue to use a variety of analytical tools. Linear programing is only one of these tools. It is important now to learn all we can about it in order to make the most of the powerful new computing methods. Linear programing also gives a new and stimulating view of old problems, and this too is worthwhile.

Finally, this book will be widely and profitably read by agricultural economists of all degrees who want to become more familiar with linear programing. It will help them to choose the least-cost mixture of analytic methods for solving problems.

Ronald L. Mighell
Burton L. French

Bibliography of Food and Agriculture Marketing. Food and Agriculture Organization of the United Nations, Rome, Italy. 210 pages. 1958.

THE PURPOSE of this bibliography is to help workers in marketing to overcome some of the obstacles to a greater awareness of international experience. It concentrates on publications in countries other than the United States and Canada, because of the immediate need for such material written in languages most easily read by those likely to use it.

FAO Marketing Guides. Number 1.—*Marketing Problems and Improvement Programs.* 260 pages. $2.50. Number 2.—*Marketing Fruit and Vegetables.* 205 pages. $2. Food and Agriculture Organization of the United Nations, Rome, Italy. 1958.

THESE ARE PUBLICATIONS in a new FAO series designed to meet the general demand for information on methods of improving the handling of agricultural products between the producer and consumer, avoiding wastage, and reducing costs.

Coffee in Latin America. Productivity Problems and Future Prospects. I—*Columbia and El Salvador.* Food and Agriculture Organization of the United Nations. Columbia University Press. 144 pages. 1958. $1.75.

The State of Food and Agriculture 1958. Food and Agriculture Organization of the United Nations. Columbia University Press. 222 pages. 1958.

The Case for an International Development Authority. By Commander Sir Robert G. A. Jackson. Edited, with an introduction by Harlan Cleveland. Syracuse University Press. 70 pages. 1959.

Selected Recent Research Publications in Agricultural Economics Issued by the United States Department of Agriculture and Cooperatively by the State Colleges [1]

ANDERSON, K. E., AND HAWES, R. L. MILK CONSUMPTION IN NONPROFIT SUMMER CAMPS. U.S. Dept. Agr. Mktg. Res. Rpt. 333, 22 pp., illus. June 1959.

In a survey of 109 nonprofit summer camps in 3 Northeastern States, it was found that the number of times milk was served each day, the milk purchasing practices followed by camp directors, the number and kinds of competing beverages available, and methods of serving have an appreciable effect on the level of milk consumption.

BAKER, R. L. INTEGRATING EGG PRODUCTION AND MARKETING. U.S. Dept. Agr. Mktg. Res. Rpt. 332, 46 pp., illus. June 1959.

Analyzes circumstances responsible for growth by integrated operations in egg industry and appraises their future importance in egg marketing. Integrated methods of producing and marketing eggs are resulting in reduced unit costs for many firms in the egg industry.

BARLOW, F. D., JR., COOPER, A. S., JR., AND VIX, H. L. E. POTENTIAL MARKETS FOR PARTIALLY ACETYLATED COTTON. U.S. Dept. Agr. Mktg.

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[1] State publications may be obtained from the issuing agencies of the respective States.

Res. Rpt. 324, 22 pp., illus. July 1959. (Agr. Mktg. Serv. and Agr. Res. Serv. cooperating.)

Researchers investigated the potential market for partially acetylated cotton in laundry items. They found that the cost of partial acetylation would probably be more than offset by increased service life of the cotton. Cotton treated in this way is highly resistant to rot, mildew, heat, and scorch.

BITTING, H. W. FACTORS AFFECTING COSTS OF WHOLESALE DISTRIBUTION OF FROZEN FOODS. U.S. Dept. Agr. Mktg. Res. Rpt. 327, 56 pp., illus. June 1959.

A guide for use of frozen food wholesalers in improving efficiency and cutting food marketing costs. Major factors affecting operating costs in the industry were (1) average size of orders, (2) labor productivity in terms of man-hours per $100 of sales, (3) average hourly wage rates, (4) efficiency in use of working capital as measured by inventory levels and amount of credit extended, and (5) services provided to customers.

BOTTS, R. R. LIFE INSURANCE FOR FARM FAMILIES. U.S. Agr. Res. Serv. ARS 43-92, 62 pp., illus. June 1959.

Life insurance is becoming increasingly important in farm financial planning. This report is designed to meet the need of those who advise farm families in this field for a rather technical knowledge of the subject. It covers the types of policies; the needs served by each; and the more important policy provisions, including how greater use may be made of these provisions in the programming of life insurance to fit changing needs and circumstances.

BRENSIKE, V. J. FACTORS INFLUENCING COMPETITION AMONG FLOUR MILLS IN THE PACIFIC SLOPE STATES. U.S. Dept. Agr. Mktg. Res. Rpt. 362, 64 pp., illus. August 1959.

Covers competitive relationships among flour mills in Wash., Oreg., Calif., Idaho, Nev., Utah, and Ariz. Decline in proportion of flour produced in Pacific Northwest was due to a combination of causes, including (1) heavy exports of wheat from the area; (2) possible effects of price supports on trend toward production of lower quality, higher yielding varieties in the Pacific Northwest; (3) increases in transportation charges; and (4) a weaker demand for flour byproducts in this area.

CAMPBELL, P., AND HALL, R. THE MARKET POTENTIAL FOR COTTON LINTERS. AN ANALYSIS OF INDUSTRIAL USES OF AN AGRICULTURAL BYPRODUCT. U.S. Dept. Agr. Mktg. Res. Rpt. 344, 54 pp., illus. July 1959.

This study of factors affecting potential market for linters shows the market for cotton linters for felting uses looks good, but competitive materials and other factors are creating problems in marketing linters for chemical uses. One promising growth market for chemical linters lies in their use for making rag-content paper.

COUTU, A. J., MCPHERSON, W. W., AND MARTIN, L. R. METHODS FOR AN ECONOMIC EVALUATION OF SOIL CONSERVATION PRACTICES, ILLUSTRATED BY AN ANALYSIS OF TERRACING AND STRIP CROPPING. N.C. Agr. Expt. Sta. Tech. Bul. 137, 48 pp., illus. January 1959. (Agr. Res. Serv. cooperating).

Analyzes conditions under which terracing and selected conservation inputs will be profitable on individual farms; describes technical and economic information required and illustrates procedures to be followed in determining whether any particular set of conservation inputs would be profitable; and discusses conditions under which specific actions of individual farmers might be inconsistent with public interest.

CRICKENBERGER, R. S., AND GIBSON, W. L., JR. FARMING AS A PART OWNER. Va. Agr. Expt. Sta. Bul. 504 (Southeast Land Tenure Res. Com. Pub. 34), 42 pp. April 1959. (Agr. Res. Serv. cooperating.)

In terms of constant dollars, capital requirements for farming have increased approximately 75 percent since 1940, thus making it more difficult for young farmers to acquire ownership of efficient sized units. A farming career as part owner may enable the young farmer to obtain security of occupancy with limited capital, and may also solve the elderly farmer's problem of underutilization of farm resources. The report contains a section on leasing practices required for successful operation as a part owner.

CSORBA, J. J. THE USE OF HORSES AND MULES ON FARMS. U.S. Agr. Res. Serv. ARS 43-94, 14 pp. March 1959.

Numbers of horses and mules in the United States declined from a near all-time peak of almost 26 million in 1920 to less than 3.4 million in 1958. Among farmers using horses and mules in 1956, about two-thirds used the workstock less than 10 days during the year. About two-fifths of the Nation's work animals are to be found in the South Atlantic and East South Central areas, but even there most of them are used very little.

DAVIS, V. W., VAN ARSDALL, R. N., AND WILLS, J. E. MANAGEMENT AND COSTS OF FIELD-SHELLING AND ARTIFICIAL DRYING OF CORN IN ILLINOIS. Ill. Agr. Expt. Sta. Bul. 638, 73 pp., illus. February 1959. (Agr. Res. Serv. cooperating.)

Comparison of field-shelling and drying and conventional picking and storing indicates that a farmer should handle 7,000 to 7,500 bushels of corn annually before considering a shift in harvesting method. A 2-man crew represented the most practical and efficient use of man-and-machine hours over the entire harvesting season. The rate of adoption of shelled-corn methods will depend greatly on replacement needs for storage and mechanical pickers. Improvements in the efficiency of field shellers and heated-air driers are needed to reduce costs and to make the shift to field-shelling and artificial drying economically more feasible.

DAY, L. M., AUNE, H. J., AND POND, G. A. EFFECT OF HERD SIZE ON DAIRY CHORE LABOR. Minn. Agr. Expt. Sta. Bul. 449, 20 pp., June 1959.

Potential labor economies resulting from increased size of herd and adoption of new techniques of production are reported for various situations. Because dairy labor requirements are characterized by seasonal variations, labor inputs for the pasture- and barn-feeding seasons are shown separately. Illustrations are given of how these data can be used effectively in selecting the operations and size of herd that best fit a particular farm.

DENNIS, C. C. THE LOCATION AND COST OF STRAWBERRY PRODUCTION. Calif. Agr. Expt. Sta. Giannini Found. of Agr. Econ. Mimeo Rpt. 217, 25 pp., illus. March 1959. (Agr. Mktg. Serv. U.S. Dept. Agr. cooperating.)

Presents the changing production pattern and current production costs in several important strawberry producing areas. Considerable variation was found among regions in most of the cost determinants. These variations are reflected in the range among regions in average total cost per pound, which varied from a low of 9.5 cents in Washington to a high of 25.1 cents in Florida.

DEXTER, W. WHAT MAKES FARMERS' PRICES. U.S. Dept. Agr. Inform. Bul. 204, 22 pp., illus. April 1959.

Economic forces that affect prices of crops and livestock described in language for general reader and illustrated with charts. Factors that influence farmers to produce and consumers to buy, and how they add up in terms of the prices farmers get, presented. Effects on farm prices are discussed in chapters on (1) the general price level, (2) changes in supply, (3) income and prices, (4) seasonal price changes, (5) marketing margins and farm prices, and (6) Government programs and prices.

DOTY, H. O. Jr. PATTERNS OF RICE DISTRIBUTION IN THE UNITED STATES AND TERRITORIES. U.S. Agr. Mktg. Serv. AMS-306, 19 pp., illus., May 1959.

Study was conducted in 1956–57 to provide the domestic rice industry with fundamental information on the characteristics of the domestic market for rice.

DUBOV, I., AND MACPHERSON, D. D. FARM-TO-RETAIL PRICE SPREADS FOR CHEDDAR CHEESE IN THE SOUTH. U.S. Dept. Agr. Mktg. Res. Rpt. 318, 23 pp., illus. April 1959.

Eight lots of cheese produced and marketed in the Southeast were analyzed as to costs and merchandising methods from the time the whole milk was received at the plant until the cheese was offered for sale by retailers. The lots were produced in 4 different plants at different times of the year. Total plant costs ranged from 30.2 to 35.5 cents per pound. Prices to consumers ranged from 39 to 69 cents per pound; farm-to-retail price spreads varied from 17 to 48 cents; and the farmer's share of the consumer's dollar ranged from 31 to 56 percent.

FARNWORTH, V. THE INEDIBLE TALLOW AND GREASE INDUSTRY: CHANGES IN MARKETS, PRACTICES, AND COSTS. U.S. Dept. Agr. Mktg. Res. Rpt. 342, 56 pp., illus. July 1959.

Industrial use of inedible tallow and grease has been steadily decreasing while increasing availability of raw materials has created a surplus of inedible tallow and grease. The largest new potential domestic market for inedible tallow and grease is the mixing of these fats with animal feeds, but the market potential has yet to be fully realized. Renderers must consider the problem of quality control to take advantage of this and other potential markets for their byproducts.

FRANKLIN, E. R., FUHRIMAN, W. U., AND PARRISH, B. D. ECONOMIC PROGRESS AND PROBLEMS OF COLUMBIA BASIN PROJECT SETTLERS. Wash. Agr. Expt. Sta. Bul. 597, 46 pp., illus. January 1959. (Agr. Res. Serv. cooperating.)

Columbia Basin Irrigation Project, as planned, will irrigate 600,000 acres. The project's economy is changing rapidly. In 1956, on units under development for 4 or 5 years, owners averaged $3,300 net returns, renters $7,000, and owner-renters $8,600. Typical budgets have been prepared that forecast incomes after full development ranging from $2,900 to $7,000 for single units, and $5,100 to $15,900 for two units, assuming no debts or rent.

GAARDER, R. O. COMPARISON OF TWO METHODS OF ESTIMATING BACKFAT THICKNESS IN LIVE HOGS—HUMAN JUDGMENT VS. ULTRASONICS. A PRELIMINARY REPORT. U.S. Agr. Mktg. Serv. AMS-318, 38 pp., illus. June 1959.

On a test on 170 live hogs measurements made with an ultrasonic device gave better estimates of average carcass backfat thickness than estimates by an experienced hog grader. The ultrasonic device sends a hi-frequency sound wave through the backfat of the hog. After the sound wave reaches the boundary between backfat and lean, or between backfat and backbone, it is reflected back to the surface. The time used for the sound to go down through the fat and return is used as the measure of the backfat thickness.

GERTEL, K. PROFITABLE ORGANIZATIONS FOR COMMERCIAL FARMS OF POTTER COUNTY, PENNSYLVANIA. Pa. Agr. Expt. Sta. Bul. 644, 37 pp. February 1959. (Agr. Res. Serv. cooperating.)

Recommended organization of farms with 50, 100, 125, and 250 acres of cropland maintains livestock pattern now generally followed on Potter County farms but involves shifting of poorer croplands to grass and legume mixtures and a combination of off-farm work and part-time farming for farms with 50 acres of cropland. Additional investments needed range from less than $1,000 to $7,700; returns to families under suggested organization would range from about $5,000 to $10,000 after allowing for interest on the additional capital.

GERTEL, K., FREY, J. C., AND MARTY, R. J. USE OF IDLE LAND IN POTTER COUNTY, PENNSYLVANIA, FOR CROPS, PASTURE AND FOREST. Pa. Agr. Expt. Sta. Bul. 642, 46 pp., illus. February 1959. (Agr. Res. Serv. and Forest Serv. cooperating.)

Of the 40,000 acres of idle land in Potter County, about 21,000 acres could be used for crops with good to fair prospects of annual returns ranging from about $6 to $27 per acre, exclusive of interest on clearance or acquisition costs. Approximately $24 to $40 per acre could be expected for small additions of seeded pasture to existing farms. Prospects of profitable pasture production are good for most of the idle land in the county.

Gould, W. A., Crawford, T. M., Brown, W. N., and Sidwell, A. P. A STUDY OF SOME OF THE FACTORS AFFECTING THE GRADE AND RELATIONSHIPS OF FRESH AND PROCESSED VEGETABLES. IV. WHOLE KERNEL SWEET CORN FOR CANNING AND FREEZING. Ohio Agr. Expt. Sta. Res. Bul. 826, 72 pp., illus. Jan. 1959. (U.S. Dept. Agr. Agr. Mktg. Serv. cooperating.)

This study found a direct relationship between raw and processed grades of sweet corn, but the grades were displaced, particularly in the case of the canned product. The grade relationship between raw and frozen corn was more direct. These relationships, however, varied with variety and season.

Gray, L. R. MARKETING COSTS AND PRICE SPREADS FOR EGGS, FRYING CHICKENS, AND TURKEYS SOLD IN SAN FRANCISCO. U.S. Dept. Agr. Mktg. Res. Rpt. 314, 44 pp., illus. April 1959.

Technological advances in assembly and distribution of eggs have enabled low price spreads to prevail in the San Francisco market. Direct farm-to-retail price spreads for all eggs sold through retail stores in Dec. 1956 and June 1957 averaged 14 cents a dozen. Cumulative gross farm-to-retail price spreads for ready-to-cook fryers processed in the South and sold through chain-owned retail poultry departments in San Francisco in June 1957 averaged 26.1 cents a pound. Similar gross spreads for other types of distribution channels ranged from 12 to 28.5 cents per pound. Cumulative gross farm-to-retail price spreads for both fresh and frozen medium-weight turkeys, ready to cook, in all retail outlets varied seasonally, but average margins for Nov. and Dec. 1956 and June 1957 were 17 cents per pound.

Haldeman, R. C. POTENTIAL EFFECTS OF ST. LAWRENCE SEAWAY ON COSTS OF TRANSPORTING GRAIN. U.S. Dept. Agr. Mktg. Res. Rpt. 319, 149 pp., illus. April 1959.

Grain from major producing areas of U.S. can be shipped to foreign countries through St. Lawrence Seaway at costs substantially lower than charges by present routes. There appears to be no advantage in shipping grain over the seaway for delivery to U.S. eastern and southeastern milling points. Comparisons are based on studies of carrier costs and shipper charges for transporting grains by barge on inland waterways, by rail, by truck, by St. Lawrence shipping before use of seaway, and by combinations of these, in relation to prospective costs of shipping in oceangoing vessels from lake ports over the new seaway and directly to foreign destinations.

Hansing, Frank D. BROILER COSTS AND RETURNS IN LOWER DELAWARE, 1952–55. Del. Agr. Expt. Sta. Bul. 327, 30 pp., illus. February 1959. (Agr. Res. Serv. cooperating.)

Records were analyzed for about 2,900 flocks containing about 25 million broilers that were sold between mid-1952 and mid-1955. Size of flock had little influence on returns for flocks containing less than 20,000 birds. Flocks sold at weights between 2¾ and 3¼ pounds had the highest return per thousand. Data indicate increasing returns for flocks up to 10 weeks of age and decreasing returns for each week thereafter.

Hochstim, E. S. EMPLOYEE FOOD SERVICES IN MANUFACTURING PLANTS: MANAGEMENT APPRAISALS, NATURE AND EXTENT, VENDING MACHINES. U.S. Dept. Agr. Mktg. Res. Rpt. 325, 100 pp., illus. June 1959.

Describes the market for food services which are provided by manufacturing companies for their employees—the kinds of plants that are and are not included in it, the types of facilities offered, management appraisals of the pros and cons of providing on-premise food, attitudes toward company vs. contractor management of food services, financial arrangements, purchasing practices, appraisals of suppliers. Data on vending machines are also shown.

Hughes, W. F., Magee, A. C., Jones, D., and Thaxton, E. L. ECONOMICS OF WATER MANAGEMENT FOR COTTON AND SORGHUM PRODUCTION, HIGH PLAINS. Texas Agr. Expt. Sta. Bul. 931, 17 pp. (Agr. Res. Serv. cooperating.)

Four alternative water-management systems designed to offset effects of a declining water supply are available to operators of irrigated farms in the High Plains. Based on 1946–56 average prices, the most profitable system was that in which a full-season hybrid sorghum is the only crop irrigated after August 1. The maximum feasible annual expenditure for water under these circumstances for a typical 320-acre fully irrigated farm is estimated to be $22.15 per acre for a tenant, $14.40 for a landlord, and $38 for an owner-operator.

Hunter, J. S. CONSUMER PREFERENCE FOR A 6-TO-1 APPLE JUICE CONCENTRATE. U.S. Dept. Agr. Mktg. Res. Rpt. 343, 27 pp., illus. July 1959.

Homemakers gave significantly higher ratings to new sevenfold concentrated apple juice than to 2 single-strength commercial apple juices of good quality, according to this sample of 198 households. Tests were made to learn whether the new product has a reasonable chance for success if processed commercially.

Johnson, M. B. VOLUME-WEIGHT RELATIONSHIPS OF FARMER'S STOCK PEANUTS STORED IN BULK. U.S. Agr. Mktg. Serv. AMS–303, 19 pp., illus. May 1959.

Provides information on weight per cubic foot of farmers' stock peanuts stored in bulk, and the effect of certain grade factors and length of storage on the relation of volume to weight of peanuts.

Larkin, L. C., and Updike, A. W. MARKETING MARGINS FOR SUGAR. U.S. Dept. Agr. Mktg. Res. Rpt. 311, 16 pp., illus. March 1959.

Household consumers paid 16 percent more per pound for sugar in 1958 than in 1950, largely because of higher marketing costs. Rise in retail sugar prices from 9.7 to 11 cents per pound during 1950–57 is analyzed in detail. Spread in prices between what the farmer gets and what the consumer pays for sugar rose 0.7 cent per pound during 1950–57. Rise in retail prices in 1950–57 was accounted for by higher costs of transportation, labor, wholesaling and retailing, and other factors.

LASSITER, R. L. JR., AND CAPEL, G. L. ECONOMIC CHARACTERISTICS OF THE FLORIDA CHILLED CITRUS JUICE INDUSTRY. U.S. Dept. Agr. Mktg. Res. Rpt. 305, 15 pp., illus, March 1959.

Florida producers of chilled orange juice increased their use of fresh oranges from 3 million boxes in 1954–55 to over 6 million in 1957–58. In 1957–58, chilled orange juice accounted for 97 percent of total sales of chilled citrus juices produced in Florida. Distribution of citrus juices to consumers is primarily in quart fiberboard containers and through dairy outlets.

LERAY, NELSON, JR., AND CROWE, G. B. LABOR AND TECHNOLOGY ON SELECTED COTTON PLANTATIONS IN THE DELTA AREA OF MISSISSIPPI, 1953–1957. Miss. Agr. Expt. Sta. Bul. 575, 23 pp. April 1959. (Agr. Res. Serv. cooperating.)

Labor requirement were lowered significantly between 1953 and 1957. The shift from intensive to extensive enterprise, as average cotton acreage decreased from 718 to 407 acres, accounted for roughly 30 percent of the reduction in man-hour requirements, while the net effect of the expanded use of new technology resulted in an average reduction in man-hour requirements of 10 to 12 percent.

LIFQUIST, R. C. BUYING PRACTICES AND FOOD USE OF EMPLOYEE FOOD SERVICES IN MANUFACTURING PLANTS. U.S. Dept. Agr. Mktg. Res. Rpt. 326, 135 pp., illus. June 1959.

Summarizes preliminary findings of a nationwide survey of inplant food services and includes comprehensive data on expenditures for and use of food by these facilities. Almost 6,000 manufacturing plants with 250 or more employees—about half of the plants of this size in the U.S.—provided some type of regular, on-premise, food service facility for use of plant personnel.

MAITLAND, S. T., AND FISHER, D. A. THE HIRED FARM WORKING FORCE OF 1957. U.S. Dept. Agr. Inform. Bul. 208, 67 pp., illus. June 1959.

Hired farm working force in 1957 totaled nearly 4 million workers and was the largest since 1950. Most of the increase over 1956 was among seasonal workers, with fewer than 25 days of farm wage work during the year. Among workers doing 25 days or more of farm wage work, there were significant increases in the proportions of young persons aged 14 to 17 and of male workers.

MANCHESTER, A. C. THE CHANGING ROLE OF FRUIT AUCTIONS. U.S. Dept. Agr. Mktg. Res. Rpt. 331, 16 pp., illus. June 1959.

Report discusses various changes in fruit marketing during last 25 years which have altered the role and importance of fruit auctions. More and more auctions are becoming distributors of higher-priced specialty products rather than mass distributors of more standardized fruits.

MANION, W. M., AND DOUGHTY, H. N. FLAXSEED STORAGE AT COUNTRY ELEVATORS IN MINNESOTA, NORTH DAKOTA, AND SOUTH DAKOTA. U.S. Dept. Agr. Mktg. Res. Rpt. 350, 55 pp., illus. July 1959.

This report is on marketing practices and costs of flaxseed storage facilities, operations, and practices employed in storing and handling at country elevators. This is a companion report to Mktg. Res. Report 301.

MARSCHNER, F. J. LAND USE AND ITS PATTERNS IN THE UNITED STATES. U.S. Dept. Agr. Agr. Handb. 153, 273 pp., illus. April 1959.

Describes the underlying physical factors of land use and their influence in relation to major historical and still evolving institutional determinants of agricultural development and land use. Impacts of industrialization and of the continuing technological revolution within agriculture are emphasized. A pioneering feature is the inclusion of aerial photographs of 168 local areas with descriptive legends.

MOORE, E. J. FLORAL MARKETING BY WHOLESALE GROWERS IN NEW YORK AND CHICAGO. U.S. Dept. Agr. Mktg. Res. Rpt. 323, 44 pp. May 1959.

This report is based on data obtained from a sample of 136 growers in the N.Y. market area and 96 in the Chicago area. It describes the marketing channels, methods, practices, costs, and services used by growers in marketing floral products. In both markets, wholesale growers sold most of their cut flowers to commission and merchant wholesalers, and most of their potted plants to retail outlets.

NOLAN, F. L., AND LEVINE, D. B. CONSUMERS' CONCEPTS OF FABRIC. A MARKETING STUDY OF THE RELATIVE IMPORTANCE OF FABRIC CHARACTERISTICS IN THE SELECTION OF WOMEN'S CLOTHING. U.S. Dept. Agr. Mktg. Res. Rpt. 338, 60 pp., July 1959.

Women look for these three characteristics in dresses, regardless of occasion or season: (1) Ability of the fabric to hold shape; (2) degree to which it will or will not wrinkle; and (3) colorfastness. Reaction to or evaluation of the fabric in the dress was also strongly affected by the interrelationship of fabric, style, and workmanship. Cost is also an important factor. Cotton was judged the most versatile fiber.

OLSON, RUSSELIO. SOME OPPORTUNITIES FOR IMPROVING FARM INCOME IN SOUTHEASTERN OHIO. Ohio Agr. Expt. Sta. Res. Bull. 832, 39 pp. March 1959. (Agr. Res. Serv. cooperating.)

Many farmers in southeastern Ohio can increase their incomes by obtaining full-time work in industry or by expanding efficient livestock production. A full-time off-farm job, with as much farming as can be carried on, is the most profitable use the operator can make of his labor. Net income could be increased about $2,000 for farms of all sizes by using about $12,000 additional capital to shift some permanent pasture to cropland, improve permanent pasture, and maintain a good-quality dairy herd producing grade A milk for sale.

PUTERBAUGH, H. S., AND KOTTKE, M. W., TECHNICAL AND ECONOMIC CHARACTERISTICS OF IRRIGATION ON CONNECTICUT FARMS. Conn. (Storrs) Agr. Expt. Sta. Bul. 340, 42 pp., illus. (Agr. Res. Serv. cooperating.)

Supplemental irrigation has become increasingly important in Connecticut in recent years. Among 167 irrigating farms surveyed in 1957, the average number of irrigated acres was 39.1 for vegetable farms, 48.8 for potato-tobacco farms, and 59.2 for dairy farms.

Reese, R. B. FAMILY PURCHASES OF SELECTED FROZEN FRUITS AND VEGETABLES. U.S. Dept. Agr. Mkgt. Res. Rpt. 317, 110 pp., illus. April 1959.

Compares data from the 1955 Household Food Consumption Survey with information from the Market Research Corp. of America to discover demand relationships that are not subject to wide short-term fluctuations. The study reports on family characteristics that reflect the economic and social factors affecting the purchasing of frozen fruits and vegetables; what changes, if any, have occurred in the levels of family purchases for these items; if these changes can be related to income or residence of consumer; and if general patterns or relationships exist that may be useful in projecting potential developments in this market. This study also provides the basis for projections of future demand for frozen fruits and vegetables and other foods.

Rogers, G. B., and Bardwell, E. T. ECONOMIES OF SCALE IN CHICKEN PROCESSING. U.S. Agr. Mktg. Serv. AMS–331, 12 pp., illus. August 1959. (New Hamp. Agr. Expt. Sta. and Mass. Agr. Expt. Sta. cooperating.)

Capacities of the plants in this study ranged from 150 to 10,000 broilers an hour. Costs per pound for processing broilers went down as size of plant went up. Economies of scale accruing to successively larger plants are considerably less with fowl than with broilers.

Skrabanek, R. L., and Ducoff, L. J. SOCIAL SECURITY AND THE TEXAS FARMER. Texas Agr. Expt. Sta. Bul. 928, 18 pp., illus. April 1959. (Agr. Mktg. Serv. cooperating.)

Presents results of interviews conducted in summer 1956, a year and a half after the 1954 amendment to the Social Security Act which provided Old Age and Survivors Insurance coverage for self-employed farmers was enacted. The survey covered operators' knowledge about OASI, their sources of information about OASI, their coverage, their retirement plans, and their opinions of OASI.

Snitzler, J. R., and Byrne, R. J. INTERSTATE TRUCKING OF FROZEN FRUITS AND VEGETABLES UNDER AGRICULTURAL EXEMPTION. U.S. Dept. Agr. Mktg. Res. Rpt. 316, 88 pp., March 1959.

This study of transportation of frozen fruits and vegetables under the exemption of agricultural commodities from rate and route control by the ICC is the second report designed to provide shippers, processors, transportation groups, and others concerned with information on the effects of the exemption. This study deals with calendar years 1955 and 1957, to reflect conditions in the frozen fruit and vegetable industry preceding and following the 1956 court decisions declaring frozen fruits and vegetables to be exempt commodities.

Strickler, P. E., and Ahalt, J. D. HARVESTING THE 1956 CORN CROP. U.S. Agr. Res. Serv. ARS 43–91, 20 pp. April 1959.

Of the 75.6 million acres of corn harvested in 1956, 86 percent was for grain, 9 percent for silage, 4 percent for hogging and grazing, and about 1 percent for feeding without removing the ears. Almost 90 percent of the 54.3 million tons of silage was harvested with field forage harvesters. Seventy-eight percent of the acreage of corn for grain was picked with mechanical pickers.

Taylor, C. C., and Burch, T. A. PERSONAL AND ENVIRONMENTAL OBSTACLES TO PRODUCTION ADJUSTMENTS ON SOUTH CAROLINA PIEDMONT AREA FARMS. S.C. Agr. Expt. Sta. Bul. 466 (Pub. 33 of Southeast Land Tenure Res. Com.), 36 pp. December 1958. (Agr. Res. Serv. cooperating.)

The major obstacles that impede the progress of individual farmers in the Piedmont in adopting production adjustments and improvements were age and physical handicaps; limited education and training; rapidity of changes in the agricultural economy; inadequate resources; and poor coordination of farm and off-farm employment.

Thuroczy, N. M., and Schlegel, W. A. COSTS OF OPERATING SOUTHERN RICE MILLS. U.S. Dept. Agr. Mktg. Res. Rpt. 330, 54 pp., illus. June 1959.

Three-fourths of all differences in total costs per 100 pounds of rough rice milled in 23 southern mills during the 1956–57 milling season resulted from differences in the volume produced and in the percentage packaged in consumer containers of 5 pounds or less. Total cost per 100 pounds of rough rice in the 23 mills for all types of services, excluding transportation and the cost of rough rice, ranged from 63 cents to $1.48, with an average of 98 cents.

U.S. Agricultural Marketing Service. DEVELOPMENTS IN MARKETING SPREADS FOR AGRICULTURAL PRODUCTS IN 1958. U.S. Agr. Mktg. Serv. AMS–316, 32 pp., illus., June 1959. (Reprinted from Hearings, part 3, before the Subcommittee of the Committee on Appropriations, House of Representatives, 86th Cong., First Session.)

This report discusses food prices and the cost of living, recent changes in food prices and marketing changes, management efforts to control costs, results and progress of special price spread studies on various products, and offers a list of recent publications on margins, costs, and practices.

U.S. Agricultural Marketing Service. MARKETING COSTS AND MARGINS FOR FRESH MILK. U.S. Dept. Agr. Misc. Pub. 733, 15 pp., illus. Feb. 1959 (rev.)

Briefly describes the marketing of fresh (or fluid) milk, the cost of performing the various marketing operations, and variations in these costs and in the price spread between farmers and consumers.

U.S. Agricultural Marketing Service. MARKETING MARGINS FOR WHITE BREAD. U.S. Dept. Agr. Misc. Pub. 712, 14 pp., illus. April 1959.

This report brings to date a publication issued in 1956. Costs of marketing white bread are studied from 1948 to 1958.

U.S. Agricultural Research Service, Farm Economics Research Division. LAND OWNERSHIP IN THE GREAT PLAINS. A PRELIMINARY RE-

U.S. GOVERNMENT PRINTING OFFICE: 1959

PORT. U.S. Agr. Res. Serv. ARS 43-93, 31 pp., illus. June 1959.

In the 10 Great Plains States, 99 percent of the privately owned land is in some agricultural use. The average ownership unit has grown from 570 acres in 1945 to 643 acres in 1958. Nearly 30 percent of the owners are 65 or older; 45 percent of the owners do not live on their farm or ranch land. Although there were fewer owners in 1958 than in 1945, there was little change in the proportional distribution of land among those who own it.

VAN ARSDALL, R. N. SELF-FEEDING SILAGE TO BEEF CATTLE FROM HORIZONTAL SILOS—A STUDY OF 49 FARMS. Ill. Agr. Expt. Sta. Bul. 642, 44 pp., illus. April 1959. (Agr. Res. Serv. cooperating.)

Silos on these farms averaged a capacity of 181 tons of silage. Spoilage decreased by 1 percent for each additional 50 tons of silage within the observed range of 60 to 500 tons. Initial costs of 200-ton silos varied from $5 to $9 per ton of capacity; farmers placed the useful life of horizontal silos at 15 to 30 years. Horizontal feeding space averaged 4 inches per animal, but 3 inches per animal resulted in no ill effects. Feeding gates performed satisfactorily on two-thirds of the farms; suspended gates were the most effective in nearly all respects.

YOUMANS, E. G. THE EDUCATIONAL ATTAINMENT AND FUTURE PLANS OF KENTUCKY RURAL YOUTHS. Ky. Agr. Expt. Sta. Bul. 664, 46 pp. Jan. 1959. (Agr. Mktg. Serv. cooperating.)

Examines the socioeconomic backgrounds, experiences, and personal characteristics of a special group of rural youths to discover and identify the factors that influence their formal educational attainments and future plans. The population studied consists of boys and girls 16 and 17 years old and their families. This study adds to the existing evidence that differences in socioeconomic status are associated with differences in educational attainments.

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